



Courtyard with ritual fountain, Grand Mosque, Dakar, Senegal. Built in 1964, the mosque, with its tiles and pointed horseshoe arches, faithfully follows the Moorish architectural style.

Bjorn Bolstad-Peter Arnold, Inc

FUNK & WAGNALLS NEW ENCYCLO- PEDIA

VOLUME 21

RUSSIAN SOVIET FEDERATED SOCIALIST
REPUBLIC to SOMALILAND

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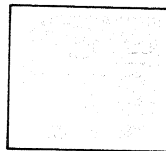
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NEW
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LIST OF ABBREVIATIONS USED IN THE TEXT*

abbr.	abbreviated	fr.	from	OHG.	Old High German
AC; a-c	alternating current	Fr.	French	ON.	Old Norse
A.D.	<i>anno Domini</i> (Lat., in the year of the Lord)	ft.	foot	ONF.	Old Norman French
alt.	altitude	g	gram	OT.	Old Testament
AM.	<i>ante meridiem</i> (Lat., before noon)	Gael.	Gaelic	oz.	ounce
AM	amplitude modulation	gal.	gallon	P.M.	<i>post meridiem</i> (Lat., after noon)
amu or AMU	atomic mass unit	Ger.	German	Pol.	Polish
anc.	ancient	Gr.	Greek	pop.	population
Ar.	Arabic	Heb.	Hebrew	Port.	Portuguese
AS.	Anglo-Saxon	Hind.	Hindustani	prelim.	preliminary
A.S.S.R.	Autonomous Soviet Socialist Republic	h.p.	horsepower	pron.	pronounced
atmo.	atomic number	hr.	hour	q.v.	<i>quod vide</i> (Lat., which see)**
at.wt.	atomic weight	Hung.	Hungarian	r.	reigned
b.	born	Hz	hertz or cycles per second	R.	River
bbl	barrel	i.	Island	rev.	revised; revision
B.C.	before Christ	l.e.	<i>id est</i> (Lat., that is)	R.R.	railroad
bd.ft.	board feet	in.	inch	Rom.	Rumanian
bey or BeV	billion electron volts	Ind.	Indian	Rus.	Russian
b.p.	boiling point	Ir.	Irish	Ry.	railway
B.T.U.	British Thermal Unit	It.	Italian	S.	south; southern
bu.	bushel	K.	Kelvin	sec.	second
Bulg.	Bulgarian	kg	kilogram	S.F.S.R.	Soviet Federated Socialist Republic
C.	centigrade	kHr	kilohertz	Skr.	Sanskrit
cent.	century	km	kilometer	Sp.	Spanish
Chin.	Chinese	kw	kilowatt	sp-gr.	specific gravity
cm	centimeter	kw hour	kilowatt hour	sq.	square
Co.	County	lat.	latitude	sq.mi.	square mile
colloq.	colloquial	Lat.	Latin	S.S.R.	Soviet Socialist Republic
cu.	cubic	lb.	pound	St.; Ste.	Saint
Czech.	Czechoslovakian	long.	longitude	Som.	Sumerian
d.	died	m	meter	Sw.	Swedish
Dan.	Danish	M.	Middle	temp.	temperature
DC; d-c	direct current	mev or MEV	million electron volts	trans.	translation
Du.	Dutch	mg	milligram	Turk.	Turkish
E.	east; eastern	MHz	megahertz	U.K.	United Kingdom
ed.	edition; editor	mi.	mile	U.N.	United Nations
Egypt.	Egyptian	min.	minute	U.S.	United States
Eng.	English	M.L.	Medieval Latin	U.S.A.	United States of America
est.	estimated	mm	millimeter	U.S.S.R.	Union of Soviet Socialist Republics
ev or EV	electron volt	mod.	modern	var.	variant
F.	Fahrenheit	m.p.	melting point	vol.	volume
fl.	flourished	m.p.h.	miles per hour	vs.	versus or against
FM	frequency modulation	Mt(s).	Mount, Mountain	W.	west; western
		N.	north; northern	yd.	yard
		Norw.	Norwegian		
		N.T.	New Testament		
		OE.	Old English		
		Of.	Old French		

*For a more extensive listing of abbreviations, widely used by authoritative sources in many fields, see ABBREVIATIONS. Charts of pertinent abbreviations also accompany the articles BIBLICAL CANON OF THE DEGREE, ACADEMIC ELEMENTS, CHEMICAL, MATHEMATICAL SYMBOLS, and WEIGHTS AND MEASURES. Accent marks and special letters are explained in the article DIACRITIC MARK.

**The abbreviation (q.v.) stands for the Latin words "quod vide", meaning "which see". The placement of this abbreviation after a word—or a name or term—indicates that the word itself is the title of a separate article in the encyclopedia. By looking up the article on this word, or the entries on each word in a series that is followed by the plural form (qq.v.) of the abbreviation, the reader will find specific information about the words used as well as data about the main topic of the article he is reading.

FUNK & WAGNALLS NEW ENCYCLOPEDIA

RUSSIAN SOVIET FEDERATED SOCIALIST REPUBLIC, largest of the fifteen constituent republics of the U.S.S.R., including most of the territory once constituting the Russian Empire (see **RUSSIA**), and now occupying 76 percent of the area and nearly 55 percent of the population of the Soviet Union. The Russian S.F.S.R. is bounded on the n. by the Arctic Ocean, on the e. by the Pacific Ocean, on the s. by China, the Kazakh S.S.R., Azerbaidzhan S.S.R., Georgian S.S.R., and Ukrainian S.S.R., and on the w. by the White Russian S.S.R., Latvian S.S.R., Estonian S.S.R., and Finland. Area, 6,501,500 sq.mi. For additional information see **SIBERIA**; **UNION OF SOVIET SOCIALIST REPUBLICS**.

The capital and largest city of the republic, and of the Soviet Union, is Moscow (q.v.); the second largest city is Leningrad (q.v.). Other important cities include the industrial centers of Chelyabinsk, Gor'kiy, and Novosibirsk; Kazan', a commercial center; Kuybyshev, a major river port; and Sverdlovsk (qq.v.), an economic and cultural center.

THE LAND

The Russian S.F.S.R. presents an immense diversity of geographic features. The European portion of the republic is separated from the Asian portion by the Ural Mountains (q.v.). The principal topographic feature of the European region is the East European Plain, a hilly area with elevations seldom exceeding 1000 ft. The Asian portion is within the area known as Siberia. Western Siberia is largely a plain, and e. of this is the mountainous Central Siberian Plateau. From s.w. Siberia a number of mountain ranges extend in a general n.e. direction. The Arctic and Pacific coasts comprise some 20,000 mi. in length and are broken by a number of promontories and inlets.

The chief river of the European area is the Volga (q.v.), which rises in the Valday Hills (q.v.) and flows in a s.e. direction for 2194 mi. to the

Caspian Sea. Other important rivers of this region include the Don and the Northern Dvina (qq.v.). Siberia is drained by a network of rivers which, combined, provides 30,000 mi. of interior navigation. The chief rivers include the Lena, Ob', and Yenisey (qq.v.).

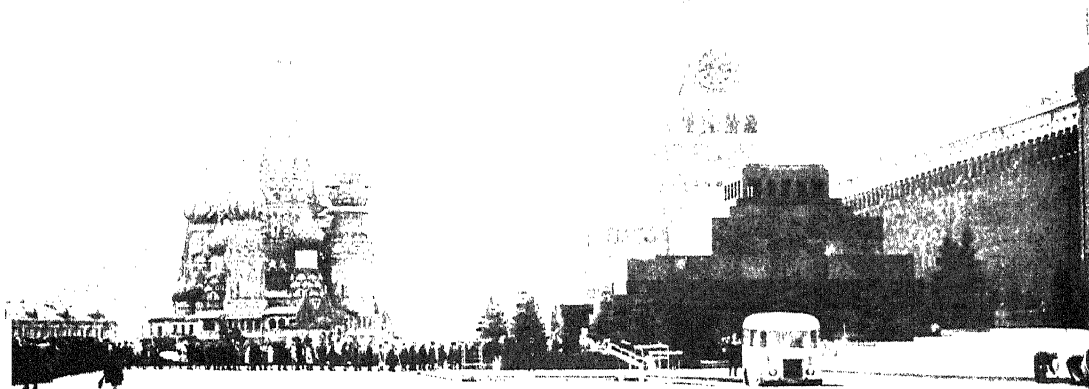
Climatic conditions range from the subtropical of the Black Sea coast in the s.w. European part to the permanently frozen arctic zone in the n. Except for the subtropical region, winters, which are harsh, usually begin around October and last until April, and in some areas until May. Siberia contains some of the coldest regions of the earth.

The Russian S.F.S.R. is extremely rich in mineral resources. The Volga region has extensive oil and gas fields. In the area of the n. Caucasus oil and gas fields are worked, and large deposits of manganese are mined. The Urals, one of the richest sources of minerals, has deposits of asbestos, chrome, copper, manganese, oil, platinum, and tungsten. The Pechora Basin in Europe and the Kuznetsk Basin in Siberia are chief sources of coal in the republic. Other minerals include bauxite, iron ore, lignite, industrial diamonds, and zinc. The large forest belt includes sizable species of pine and spruce, and such conifers as ash, elm, and maple.

With respect to soils and plants, the Russian S.F.S.R. comprises five latitudinal zones. From n. to s. are the tundra region along the Arctic Ocean coast; the forest zone, from the w. boundary to the Pacific; the steppe region, chiefly in Europe, comprising the most fertile land, known as the black-earth belt, in the republic; the semidesert zone of s.w. Siberia; and the subtropical zone in the s. part of the European region and in s.e. Siberia.

THE PEOPLE

The population of the Russian S.F.S.R. was 130,090,000 in 1970. Density is extremely uneven as a majority of the inhabitants live in the Euro-



The tomb of Vladimir Lenin in Red Square, Moscow, is visited by thousands of people each day. At right is the wall of the Kremlin; at left, the onion-domed Cathedral of Saint Basil.

UPI

pean sector. About 85 percent of the population is Russian, the remainder includes Tartars, Ukrainians, and Chuvashes. The republic is divided into smaller administrative units on the basis of either geographic proximity or race and nationality; each ethnic group has according to the Soviet constitution, a recognized right to cultural and linguistic autonomy. Within the framework of the Russian S.F.S.R. are sixteen autonomous republics, organized and named according to their major non-Russian populations, as follows: in the n.w., the Karelian A.S.S.R. and Komi A.S.S.R. (qq.v.); in the region of the Volga R., the Udmurt A.S.S.R. and the contiguous Mordvinian A.S.S.R., Chuvash A.S.S.R., Mari A.S.S.R., and Tatar A.S.S.R. (q.v.); in the n. Caucasus region, the Chechen-Ingush A.S.S.R., Kalmuck A.S.S.R., Kabardin-Balkar A.S.S.R., North Ossetian A.S.S.R., and Dagestan A.S.S.R.; in the Urals region, the Bashkir A.S.S.R. (q.v.); in central Siberia, the Tuvinian A.S.S.R., and the Buryat A.S.S.R. (qq.v.); and in n.e. Siberia the Yakut A.S.S.R. (q.v.), the largest political unit in the Soviet Union, aside from the Russian S.F.S.R. itself.

The most numerous secondary divisions are the oblasts, established for administrative purposes rather than on an ethnic basis, and usually named for the city that is the administrative center of each oblast. The forty-nine oblasts are Amur, Archangel, Astrakhan', Belgorod, Bryansk, Chelyabinsk, Chita, Gor'kiy, Irkutsk, Ivanovo, Kalinin, Kaliningrad, Kaluga, Kamchatka, Kemerovo, Kirov, Kostroma, Kuybyshev, Kurgan, Kursk, Leningrad, Lipetsk, Magadan, Moscow, Murmansk, Novgorod, Novosibirsk, Omsk, Orel, Orenburg, Penza, Perm', Pskov, Rostov, Ryazan', Sakhalin, Saratov, Smolensk, Sverdlovsk, Tambov, Tomsk, Tula, Tyumen', Ul'yanovsk, Vladi-

mir, Vologda, Volgograd, Voronezh, and Yaroslavl.

Other divisions of the republic are the six large territories in which Russians are the predominant ethnic group; five autonomous regions located within the territories, and which comprise national groups; and ten national areas, which are within either the territories or oblasts, and established for non-Russian groups.

THE ECONOMY

The Russian S.F.S.R. is the most economically developed republic in the Soviet Union, and is responsible for about 70 percent of all agricultural and industrial production in the country. In accordance with the constitution of the U.S.S.R., most property and all industry is owned by the Soviet Union. The economy is diversified. Two of the largest hydroelectric plants in the world are located in the republic: one on the Volga R. and one on the Angara (q.v.) in central Siberia.

In 1967 the republic had 15,640 collective farms and 7112 state farms. Some 304,000,000 acres were under cultivation, of which about 190,000,000 were used for grain crops. Cotton, fruit, hemp, oil seeds, sugar beets, and vegetables are grown and livestock is also raised.

The chief fishing areas of the Russian S.F.S.R. are along the Pacific coast, which yield about 25 percent of the total catch of the Soviet Union; and in the Caspian, Barents and White seas. The principal catches include cod, crab, herring, salmon, and sturgeon.

The most important lumber mills of the republic are located near Leningrad and in the Urals region.

Among the chief industries of the European sector are oil refining, shipbuilding, and the manufacture of automobiles, chemicals, electronic equipment, iron, machinery, paper and paper products, steel, textiles, tools, and transportation equipment.

RUSSIAN SOVIET FEDERATED SOCIALIST REPUBLIC

Of growing economic importance is s. Siberia; several oil refineries and plants producing chemicals, machinery, and steel have recently been opened there.

GOVERNMENT

The Russian S.F.S.R. has its own constitution and government, which is patterned after the government of the U.S.S.R.; see U.S.S.R.: *Government*. The present constitution was adopted in 1937. The highest organ of State power is the unicameral supreme soviet, members of which are popularly elected for four-year terms. The supreme soviet elects a presidium to conduct the work of the soviet between its semiannual sessions, and it appoints a Council of Ministers, characterized in the constitution as the government of the republic. Each autonomous republic has its own constitution and a government structure that is parallel to the republican government.

HISTORY

The territory that became the Russian S.F.S.R. was the first part of the former Russian empire to be ruled by a Soviet government. When, on Nov. 7, 1917, the Bolshevik revolution overthrew the provisional republican government established in March of that year (see RUSSIAN REVOLUTION), the soviets of workers' and soldiers' deputies were declared to be the organs of

government. On Jan. 31, 1918, the Third All-Russian Congress of Soviets proclaimed Russia a Republic of Soviets of Workers', Soldiers', and Peasants' Deputies. In the first Soviet constitution, ratified on July 10, 1918, the name of Russian Soviet Federated Socialist Republic was adopted by the Fifth All-Russian Congress.

The Russian S.F.S.R. was intended to include all the territory of the former Russian empire. During the civil war (1918-20), however, that followed the Soviet seizure of power, the Bolshevik government was able to hold only a part of the imperial territories, and could not extend its jurisdiction. Thus, several former imperial provinces became completely independent (Latvia, Lithuania, Estonia, and Finland), and others were united into new or extant states (the reincorporation of Poland; the incorporation of Bessarabia into Rumania). A few provinces were sovietized independently as the Ukrainian S.S.R., White Russian S.S.R., and Transcaucasian S.S.R. (see CAUCASIA). A plan of federation was drawn up in 1922 and 1923, and in January, 1924, a new constitution was promulgated, reorganizing the areas under Soviet control into the Union of Soviet Socialist Republics.

Spectators crowd around the outdoor chess tables in Gorky Park, Moscow, as the players concentrate on their games.

UPI



RUSSIAN TURNIP

RUSSIAN TURNIP. See RUTABAGA.

RUSSIAN WOLFHOUD. See BORZOI.

RUSSO-FINNISH WAR, war fought between the Republic of Finland and the Union of Soviet Socialist Republics from Nov. 30, 1939, to March 12, 1940, following the inability of the two countries to reach an agreement on Soviet demands for territorial concessions; see FINLAND: *History*.

On Nov. 30, after having broken off all diplomatic relations with Finland, the Soviet Union attacked Finland in an undeclared war. The Soviet air force bombed Helsinki and other cities; the Soviet fleet bombarded Finnish ports; and the Red Army pushed across the frontier. The Soviet Union employed a force of about twenty full divisions along many points of the 955-mi. frontier. The standing army of Finland, which at the beginning of the war consisted of three infantry divisions, a cavalry brigade, and a tank company, was bolstered by trained and partially trained reserves. With these forces the Finnish general Baron Carl Gustaf Emil von Mannerheim (q.v.) faced the Soviet attacking forces at five different points. The first offensive of the Red Army was launched against a line of field fortifications and concrete pillboxes, called the Mannerheim Line, on the 70-mi.-wide neck of the Karelian Isthmus. The Finns held the line. The four Soviet forces north of the Mannerheim Line advanced during the early part of December, but by January the Finns, aided by the intense cold, the forest-covered terrain, and by the mobility of their ski troops and armament, cut the supply and communication lines of the Red Army and forced the retreat of all its advance columns. In some cases the Russians were driven back beyond their own frontiers.

Finnish successes continued throughout January against the Red Army. The Finns destroyed a Soviet division and a tank brigade, and cut to pieces portions of other Red Army divisions attacking in the central and northern parts of Finland. As a result of recurring defeats, the Soviet military leadership was reorganized and the Soviet marshal Semën Konstantinovich Timoshenko (1895–1970) took charge of all Soviet operations against Finland. The character of the war underwent an immediate change. Timoshenko concentrated an estimated 300,000 troops against the Mannerheim Line and supported the offensive with artillery and air power.

Finnish Defense Weakens. From Feb. 1 to 10, 1940, Finnish fortifications were subjected to an artillery bombardment that reached its height when 300,000 shells a day fell on the Mannerheim Line. The war of attrition which developed

cost the Russians heavily, but it succeeded in breaking most of the Finnish resistance. Soviet troops launched a major attack on Summa on Feb. 14 and captured the city on Feb. 16. On Feb. 23 the Russians advanced to within 7 mi. of Vyborg (Finn. *Viipuri*), the key city on the western flank of the Mannerheim Line. The Finns gave ground slowly for more than two weeks, but on March 11 advance elements of the Red Army entered the city and at 11 A.M. March 12, 1940, fighting ceased on all fronts as the peace treaty was concluded.

The peace terms imposed upon Finland by the Soviet Union forced the Finns to give up 16,173 sq.mi. of territory, including the Karelian Isthmus (see KARELIAN AUTONOMOUS SOVIET SOCIALIST REPUBLIC) with the city of Vyborg and Vyborg Bay with its islands; the western and northern shores of Lake Ladoga with the cities of Kexholm (now Priozersk), Sortavala, and Suoyarvi; a number of strategic islands in the Gulf of Finland; and part of the Rybachi and Sredniy peninsulas. In addition, the Finns were forced to make concessions that included the rental to the Soviet Union of the Hangö Peninsula, and adjacent islands, for a period of thirty years, for the establishment there of a Russian military base; the granting of unrestricted transit privileges across Petsamo Province (now Pechenga) for Soviet citizens and freight; and the limiting of Finnish military forces. The treaty ended the first phase of World War II for the Finns. According to an official Finnish communiqué, Finnish casualties were 19,263 killed and 43,500 wounded; Soviet estimates of Finnish losses were considerably higher. In June, 1941, Finland joined Germany in an attack on the U.S.S.R. See UNION OF SOVIET SOCIALIST REPUBLIC: *History: The Dictatorship of Stalin*, WORLD WAR II: *The Russo German War*.

RUSSO-JAPANESE WAR, armed conflict between Russia and Japan in 1904–05. The war resulted because Russian expansion in eastern Asia ran counter to the plans of Japan to gain a foothold on the Asiatic mainland. In 1898 Russia leased Port Arthur (see LÜTA) from China, with the intention of making it a great Asiatic port and the headquarters of Russian naval power in the Pacific. Russia occupied Amur Province in 1900 and tried to secure the acquiescence of China. Meeting stern opposition from Great Britain and Japan, Russia promised to leave Chinese territory within eighteen months. The promise was not kept, and in June, 1903, Japan proposed an agreement with Russia recognizing their interests in Korea and Manchuria respectively and insuring the integrity of China and

Korea. Russia refused, and on the night of Feb. 8, 1904, the Japanese navy launched a surprise attack on Port Arthur and then blockaded the badly damaged Russian fleet.

Early Battles. In March, 1904, the Japanese First Army landed at Chemulpo (now Inch'ön) and at Nampo. It faced the Russians on the Yalu R. by late April. The Russian commander in chief, General Aleksei Nikolaevich Kuropatkin (1848–1921), decided to hold a defensive position on the Liaotung Peninsula until enough reinforcements arrived to permit him to move to the offensive. Kuropatkin's forces were spread out over a distance of 15 mi. The Japanese commander, General Tamemoto Tamesada Kuroki (1844–1923), built up a four to one troop advantage at the town of Uiju and forced a passage across the Yalu on May 1. Japanese losses were about 1100 out of a force of 40,000 men. The Russians lost some 2300 out of 7000 troops.

During May the Japanese Second Army under General Yasukata Oku (1846–1930) landed on the Liaotung Peninsula, severed communications between Port Arthur and the main Russian forces in Manchuria, captured Kinchow (now Chihnsien), won the Battle of Nanshan (May 30), and besieged Port Arthur. The Japanese Third Army under General Maresuke Nogi (1849–1912) landed on the eastern coast of Korea, and the fourth army under General Michitsura Nodzu (1841–1908) landed at Kushan on the Manchurian coast. Kuropatkin was personally ordered by Nicholas II (q.v.), Emperor of Russia, to hold Port Arthur, and he moved his main forces to Liaoyang. After defeating a Russian force of 25,000 at Wafangtien on June 14, the Japanese began to converge on Liaoyang. Kuropatkin attacked Kuroki's forces in late July and then fell back to Liaoyang. Between August 25 and September 4, the Battle of Liaoyang was fought. Although the Japanese were outnumbered 130,000 to 180,000, they defeated the Russians, who retreated toward Mukden.

The Japanese campaign had been successful, but their reserves of trained men were rapidly being exhausted. On the other side, Kuropatkin's army was being reinforced by about 30,000 men a month via the Trans-Siberian Railroad, and the commander in chief now decided to attack. The first Russian offensive was launched on the Shaho R., lasting from October 5 to October 17, and a second attack at Sandepu on Jan. 26–27, 1905. Both offensives broke down, however, and were indecisive.

Japanese Victories. Time favored their enemy and the Japanese, who had been besieging Port Arthur since May, once more tried to storm it.

After an extremely bloody assault lasting ten days, in which they lost 10,000 men, the Japanese captured the key position, called 203 Meter Hill, on Dec. 5, 1904. The Russian General Anatoli Mikhailovich Stësel (1848–1915) surrendered on Jan. 2, 1905.

Now both Kuropatkin and the Japanese commander, Marshal Iwao Oyama (1842–1916), were able to build up their forces around Mukden. Between February 19 and March 10, the Japanese took the offensive. Although their forces were outnumbered 270,000 to 330,000 and were inferior in artillery, the Japanese forced the Russians to surrender Mukden and withdraw northward. The Russians lost some 90,000 men and the Japanese about 50,000. The battle practically ended hostilities on land, but Japan still faced the threat of Russian naval power.

With their Far East naval forces contained by the Japanese, the Russians decided to send out the Baltic Fleet. The fleet, made up of forty-five ships, sailed Oct. 15, 1904, under the command of Admiral Zinovi Petrovich Rozhdestvenski (1848–1909). The fleet reached the China Sea in early May, 1905, and made for Vladivostok. The Japanese under Admiral Heihachiro Togo (1847–1934) intercepted it, May 27 to May 29, in the straits of Tsushima between Korea and Japan. The Japanese fleet, which was superior in speed and armament, sank, captured, or disabled eight battleships, nine cruisers, six special-service steamers, and several other ships in the Baltic Fleet. Some 4000 Russians were killed, and three admirals and 7300 sailors were captured. The Japanese lost three torpedo boats, 116 men killed, and 538 wounded.

Results. After Port Arthur and the defeats at Mukden and Tsushima, the emperor accepted the offer of mediation extended by United States President Theodore Roosevelt (q.v.). The Japanese, who were victorious but financially exhausted, also agreed to negotiate. On Sept. 5, 1905, the Treaty of Portsmouth was signed. Russia surrendered its lease to Liaoyang and Port Arthur, ceded the southern half of Sakhalin, evacuated Manchuria, and recognized Korea as a Japanese sphere of influence.

RUSSO-TURKISH WARS, series of conflicts between the Russian and Ottoman Turkish empires, fought during the 17th, 18th, and 19th centuries. Fundamentally, the wars resulted from the recurrent diplomatic struggle between the two powers for hegemony in the Caucasus area and in the Balkans. A contributory cause, in certain instances, was Russian resentment over the persecution of Christians in the Balkan nations subject to Turkey. Among the more impor-

RUSSO-TURKISH WARS

tant of the Russo-Turkish wars was the first, which occurred during the reign of Czar Fëor II (r. 1676-82). At the termination of the war in 1681, the Russians were in possession of most of the Turkish Ukraine. The next Russo-Turkish war of consequence, that from 1768 to 1774, brought part of the Crimea under Russian control. A renewal of hostilities from 1787 to 1792 resulted in another Russian victory and the acquisition of considerable territory, including an extensive region between the Bug and Dniester rivers. Following this struggle the Turks were also forced to recognize the Crimea as a Russian possession.

In the Russo-Turkish war from 1806 to 1812, Russia acquired Bessarabia. The next conflict, that of 1828-29, followed Russian intervention in 1827 in the Greek revolution against Turkish rule. Besides insuring independence for Greece, the Russians won numerous concessions from the Turks in this war, notably a temporary protectorate over Moldavia and Walachia and navigation rights in the Bosphorus and Dardanelles. The Crimean War (q.v.), extending from 1853 to 1855, ended disastrously for the Russians, who were confronted by a coalition that included Great Britain, France, and Turkey. Through the peace terms imposed by the victors, Russia was forced to relinquish the gains obtained in the preceding conflict and was subjected to other humiliations, particularly the loss of naval rights in the Black Sea.

After the Crimean defeat, Russian ambitions for hegemony in southeastern Europe remained dormant for more than twenty years. Turkish atrocities, in 1876, against rebellious subject peoples in the Balkans provided the Russians with ample justification for renewing the struggle. Proclaiming itself the protector of Christianity in the Balkans, the Russian empire declared war against Turkey in April, 1877. The Turks were overwhelmingly defeated in this conflict, and by Jan. 31, 1878, when hostilities ended, Russian armies had advanced to the neighborhood of Constantinople (now Istanbul), the Turkish capital. Under the provisions of the Treaty of San Stefano, signed in the following March, the Turkish empire surrendered all of its strongholds north of a line extending from San Stefano, on the Sea of Marmara, to Terkos (now Yeşilköy), on the Black Sea. The enormous gains obtained by Russia in the Treaty of San Stefano caused profound alarm among the other European powers. In June, 1878, representatives of various interested nations, including Germany and Russia, convened at Berlin for the purpose of revising the treaty. As a result of this confer-

ence, many of the Russian gains were negated; see BERLIN, CONGRESS OF; SAN STEFANO, TREATY OF.

RUST, common name applied to any of the parasitic fungi constituting the order Uredinales of the subclass Heterobasidiomycetes; see FUNGI; *Classification: Basidiomycetes*. Rusts are so called because they form orange-red spores on the stems and leaves of the seed plants they parasitize. In addition, some rusts produce galls (see GALL) and others, especially those attacking conifers, cause the formation of crowded, tufted shoots which are known as witches'-brooms. Rusts rarely cause the death of plants, but often produce dwarfing, discoloration, and developmental disturbance. Some rusts, such as those commonly attacking hollyhock and asparagus, pass their life on one host; others, such as those attacking various grains, require two or more hosts on which to complete their life cycle.

Structure and Reproduction. Plant diseases caused by rusts are also known as rusts. Among the well-known rust diseases are: black stem rust of cereal plants caused by the grain rust or wheat rust, *Puccinia graminis*, which spends part of its life cycle on plants of the genus *Berberis*; pea rust, caused by *Uromyces pisi*, which spends part of its life cycle on the common spurge; apple rust, caused by *Gymnosporangium juniperi virginianae*, which spends part of its life cycle on junipers; witches' broom of fir and spruce, caused by *Melampsorella elatina*, which spends part of its life cycle on plants of the Pink family (Caryophyllaceae); white pine blister rust, caused by *Cronartium ribicola*, which spends part of its life cycle on currant and gooseberry bushes; and stone fruit rust, attacking cherries, peaches, plums, apricots, and almonds, and caused by *Tanzschelia punctata*, which spends part of its life cycle on plants of the genera *Anemone*, *Hepatica*, and *Thalictrum*. Some rusts may be prevented by dusting or spraying plants with sulfur; most rusts which attack two or more plants may be prevented by removing the hosts of less economic or decorative importance from the immediate vicinity of the more valuable host. See PARASITE.

RUST, in metallurgy. See CORROSION, IRON.

RUSTON, city in Louisiana, and parish seat of Lincoln Parish, about 30 miles w. of Monroe. Manufactures include lumber, beverages, and bricks. It is the site of Louisiana Polytechnic Institute, founded in 1894. Pop. (1960) 13,991; (1970) 17,365.

RUTABAGA or **SWEDISH TURNIP** or **RUS- SIAN TURNIP**, or **SWED**, common name applied to a biennial herb, *Brassica napobrassica*,

belonging to the Mustard family (Cruciferae). The rutabaga is similar in most of its botanical characteristics to other herbs of the genus *Brassica* (q.v.), and is native to the temperate countries of the Old World; it is widely cultivated in cool, moist regions of the Northern Hemisphere for its large, elongated yellow roots which are used as food for humans and livestock. Like the turnip (q.v.), to which it is closely related, the rutabaga contains about 90 percent water, its chief nutritive constituent being carbohydrate.

RUTGERS, THE STATE UNIVERSITY, coeducational institution of higher learning, located in New Brunswick, N.J., with major branches in Newark and Camden and extension centers in Paterson and Jersey City. The university was chartered in 1766 as Queens College and was opened for instruction in 1771. The name Rutgers College was adopted in 1824 in honor of the American colonial patriot and philanthropist Henry Rutgers (1745–1830), who contributed generously to the support of the school. In 1945 the institution was designated the State university, and in 1956 the name was changed to its present form. The university is operated jointly by the State of New Jersey and a board of governors. Rutgers comprises colleges of arts and science, engineering, education (graduate), pharmacy, nursing, social work (graduate), and library service (graduate), and Douglass College (for women, established in 1918); and schools of law and business and a graduate school. The degrees of bachelor, master, and doctor are conferred. The university maintains research establishments concerned with various fields of pure and applied science, economics, government, and sociology as well as interdisciplinary studies, and experiment stations for engineering and agriculture. In 1973 the university libraries housed more than 1,650,000 bound volumes. In the same year the enrollment totaled more than 40,000 students, and the faculty numbered 3200. The endowment of the university in late 1971 was about \$35,740,000.

RUTH, book of the Old Testament (see **BIBLE**), in the King James Version, **THE BOOK OF RUTH**. It follows the book of Judges (q.v.) in Christian versions of the Old Testament, but in the Hebrew Bible it is found in the Writings, the third part of the canon (see **BIBLE**, **CANON OF THE**). Neither the author nor the precise date of composition are known. According to an ancient Jewish tradition, the author was the Hebrew judge Samuel (q.v.). According to modern scholars, the book, although descriptive of the period "when the judges ruled" (1:1), probably dates

from the postexilic period, more specifically, from sometime between 400 and 250 B.C.; see **Jews: Subject Judea**.

Ruth is an ancient Hebrew short story (based, perhaps, on an earlier folktale). It tells of a family from the ancient town of Bethlehem in Judah that takes refuge in Moab (qq.v.) during a famine. There the sons of the Judean family marry Moabite women. When the father and the sons die, Naomi, the bereaved mother, determines to return to Bethlehem. She urges her daughters-in-law to remain in Moab, but one of them, Ruth, insists on returning with Naomi (1:16–17). In Bethlehem, Ruth's devotion and kindness soon attract the attention of Naomi's near kinsman Boaz (2:1–4:12). The two are married and bear a child who becomes an ancestor of the Hebrew king David (q.v.).

The book of Ruth has been variously interpreted. It has been regarded as a literary protest against the restrictive marriage reforms instituted in the time of the postexilic Jewish leaders Ezra and Nehemiah (qq.v.); as pure entertainment; as an idyllic romance; as a retelling of an ancient fertility myth; and as an example of the ideal convert. The emphasis on the fact that Ruth is a foreigner, her acceptance in Bethlehem despite this fact, her place in the genealogy of King David, and the acceptance of the book as part of the Hebrew canon, all suggest a deeper and more complex purpose than entertainment or protest.

RUTH, George Herman, popularly known as **BABE RUTH** (1895–1948), American professional baseball player, born in Baltimore, Md., and educated at Saint Mary's Industrial School in that city. Ruth was one of the most phenomenally gifted and popular players in the history of baseball (q.v.). He began his career in 1914 as a left-handed pitcher for the Baltimore team of the International League. Later in the same year he played for the Providence team of the International League, and then became a member of the Boston Red Sox of the American League. He pitched for Boston until the season of 1919, when his unusual ability as a batter and fielder caused the Boston management to convert him into an outfielder. From 1920 to 1935 he played the outfield for the New York Yankees of the American League. In 1935 he became vice-president of the Boston Braves of the National League and played a number of games as an outfielder. Three years later he was a coach for the Brooklyn Dodgers of the National League.

Ruth was one of the best left-handed pitchers the game has ever known; he played in 163



Babe Ruth at bat.

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games as a pitcher, winning 92 and losing 44, for a percentage of .676. From 1919 to the end of his career he was the outstanding outfielder of his time and one of the best in baseball history. He was particularly noted as a hitter of home runs. In 1927 he hit 60 home runs in 154 games, a major league record that stood until 1961, when Roger Maris (q.v.), another American League player, hit 61 home runs in the expanded 162-game season. Ruth led the American League in home runs in ten seasons and tied for the home-run hitting championship in two seasons. His lifetime record of 714 home runs in regular-season play was broken by Henry Aaron (q.v.) in 1974. In his major-league career of 22 years, Ruth played in 2503 games and had a lifetime batting average of .342. He was elected to the Baseball Hall of Fame in 1936; see **BASEBALL HALL OF FAME AND MUSEUM, NATIONAL**. B.K.K.

RUTHENIA, former province of Czechoslovakia, now forming part of the Ukrainian S.S.R. in the Soviet Union. In March, 1939, Hungary seized all of Ruthenia, renaming it Carpatho-Ukraine; the province passed to the Soviet Union in 1940. Area, 4871 sq.mi.

RUTHENIANS, name given to Ukrainians or Little Russians, who were formerly Austrian subjects. In 1877 a Ruthenian chair was established at Lemberg University but Austria would not grant a Ruthenian university. The Russian government discouraged Ruthenian nationalism until after the revolution of 1905, when some of the oppressive regulations were relaxed. After World War I the Ruthenians in East Galicia were taken over by Poland.

RUTHENIUM, metallic element of the platinum group with at.no. 44, at.wt. 101.1, b.p. about 4100° C. (7412° F.), m.p. about 2400° C. (4352° F.), sp.gr. 12.420, and symbol Ru. It was discovered in 1844 by the Russian chemist Karl Karlovich Klaus (1796-1864). The name of the element is derived from the region of Ruthenia, now a part of the Soviet Union. The metal is grayish white and occurs in the metallic state in platinum ores. The addition of ruthenium to platinum and palladium alloys makes the alloys very hard. Such alloys have a high resistance to wear and are used in the manufacture of jewelry, in porcelain-metal restorations in dentistry, as tips for fountain pen nibs, and for nonmagnetic instrument pivots. The alloy ruthenium-molybdenum is a superconductor at temperatures below 10.6° K (-263° C. or -441.4° F.). The pure metal is superior to platinum in resistance to attack by acids, including aqua regia.

RUTHERFORD, borough of New Jersey, in Bergen Co., 9 miles S.W. of Jersey City. It is primarily a residential suburb of New York City, and is served by a railroad. Manufactures include metal products, machines, clothing, awnings, asphalt, and asbestos. Rutherford was the original site of Fairleigh Dickinson University (q.v.). Several pre-Revolutionary homes still remain in the borough. Laid out in 1862, Rutherford was incorporated in 1881. Pop. (1960) 20,473; (1970) 20,802.

RUTHERFORD, Ernest, 1st Baron Rutherford of Nelson (1871-1937), British physicist, born in Nelson, New Zealand, and educated at the University of New Zealand and the University of Cambridge. He was professor of physics at McGill University from 1898 to 1907 and at the University of Manchester during the following twelve years. After 1919 he was professor of experimental physics and director of the Cavendish Laboratory at the University of Cambridge and also held a professorship, after 1920, at the Royal Institution of Great Britain in London.

Rutherford was one of the first and most important researchers in nuclear physics. Soon after the discovery of radioactivity (q.v.) in 1896 by the French physicist Antoine Henri Becquer-

rel (see under BECQUEREL), Rutherford characterized the different components of radiations as alpha, beta, and gamma particles, and showed that alpha particles are helium nuclei. His work on the nature of radiations led to his formulation of a theory of atomic structure that was the first visualization of the atom as a dense nucleus about which electrons circulate in orbits; see ATOM and ATOMIC THEORY. In 1919 Rutherford performed a pioneer experiment in nuclear physics when he bombarded nitrogen gas with alpha particles and obtained atoms of an oxygen isotope and protons. This transmutation of nitrogen into oxygen, the first artificially induced nuclear reaction performed, gave great impetus in the ensuing decades to intensive research on the other nuclear transformations and on the



Ernest Rutherford

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nature and properties of radiations. The rutherford, a unit of radioactivity, was named in his honor.

Rutherford was elected a Fellow of the Royal Society in 1903 and served as president of that institution from 1925 to 1930. He was awarded the 1908 Nobel Prize in chemistry, was knighted in 1914, and was created a baron in 1931. His writings include *Radioactivity* (1904); *Radiations from Radioactive Substances* (1930), with the British physicists Sir James Chadwick (q.v.) and Charles Drummond Ellis (1895–), which has become a standard work; and *The Newer Alchemy* (1937).

RUTHERFORDIUM. See ELEMENTS, CHEMICAL.

RUTILE (Lat. *rutilus*, "golden red"), brilliant red or black mineral, with diamondlike luster, composed of titanium oxide, TiO_2 . It crystallizes (see CRYSTAL) in the tetragonal system, usually in prismatic crystals ranging from opaque to transparent, and less often in compact massive formations. Some iron is usually present in the mineral, and sometimes constitutes 10 percent of the total content. The streak is pale brown; the hardness (q.v.) ranges between 6 and $6\frac{1}{2}$; and the specific gravity ranges between 4.18 and 4.25. Rutile is used as a source of titanium (q.v.) and some deeply colored specimens are cut into brilliant gems with a diamondlike luster. The mineral is found as an accessory in many rocks, such as granite, dolomite, metamorphic limestone (qq.v.), and mica schist (see MICA and SCHIST), and is often found as slender crystals penetrating quartz (q.v.). In the United States it is obtained in commercial quantities from the black sands of northeastern Florida. Notable deposits are also found in Georgia, North Carolina, and Arkansas, and in Norway, France, and Switzerland in Europe.

RUTLAND, city in Vermont, and county seat of Rutland Co., on Otter Creek, about 50 miles s.w. of Montpelier. Transportation facilities include railroads and an airport. Rutland is the trading center of a rich agricultural area, and is sometimes called the "Marble City" because of the extensive marble quarries and marble works in the region. Among the industrial establishments in the city are railroad shops, marble and monument works, and factories manufacturing stone-working machinery, scales, fire clay, plaster, medical supplies, dresses, and jet-turbine components. Rutland is the headquarters of the Green Mountain National Forest. In the vicinity of the city is a popular winter-sports area; Rutland is also a summer-vacation resort. The Rutland Fair, an annual event, is held in early September. Rutland was first settled in 1770 and from 1784 to 1804 was the capital of Vermont. It was incorporated as a village in 1847 and chartered as a city in 1892. Pop. (1960) 18,325; (1970) 19,293.

RUTLANDSHIRE or RUTLAND, Great Britain, smallest county of England, bounded by the counties of Lincolnshire, Leicestershire, and Northamptonshire. It is drained by the Welland R., which forms the s. boundary of the country, which is a famous fox-hunting district. Agriculture, forestry, and iron mining are the principal industries, and manufactures include leather and hosiery. Oakham is the county seat and the only urban district. Rutlandshire was the site of important Saxon settlements in the 5th and 6th

centuries A.D., and was first mentioned as a county in the 12th century. Area, 152 sq.mi.; pop. (1971) 27,463.

RUTLEDGE, name of a family of American statesmen prominent in the 18th century.

John Rutledge (1739–1800), born in Charleston, S.C. He studied in London, England, and began practicing law in Charleston in 1761. In 1774 he became a member of the Continental Congress (q.v.), serving until 1776 and later from 1782 to 1783. During the American Revolution (q.v.) he helped draft the South Carolina constitution. He was governor of South Carolina from 1778 to 1782. In 1789, one year after participating in the State constitutional ratification convention, he was appointed associate justice of the Supreme Court of the United States. He held this position until 1791, when he resigned to take the post of chief justice of South Carolina. He was appointed chief justice of the U.S. Supreme Court by President George Washington (q.v.) in 1795. Although he served for one term, his appointment was not confirmed by the United States Senate because of his open opposition to Jay's Treaty (q.v.), which was negotiated in 1794 and disposed of outstanding Anglo-American political differences.

Edward Rutledge (1749–1800), brother of John Rutledge, born in Charleston, S.C., and studied law in England. From 1774 to 1777 he was a member of the Continental Congress, during which period he was a signer of the Declaration of Independence (q.v.) and active in the defense of North Carolina against British forces. He served in the South Carolina legislature between 1782 and 1796, and in 1798 was elected governor of the State.

RUTLEDGE, Ann. See LINCOLN, ABRAHAM.

RUWENZORI, mountain range of central Africa, located in the Great Rift Valley on the Uganda and Zaire border between Lake Albert and Lake Edward. The Ruwenzori range was discovered in 1889 by an expedition led by the British-American explorer Sir Henry Morton Stanley (q.v.), and the major peaks were explored in 1906 by the expedition of the Italian Luigi Amedeo, Duke of the Abruzzi (q.v.). Several peaks rise above 16,000 ft.; the highest are Mt. Margherita at 16,795 ft. and Mt. Alexandra at 16,750 ft. The range is commonly identified with the fabled "Mountains of the Moon", erroneously supposed by ancient geographers to be the source of the Nile R.

RUYSBROECK or **RUISBROECK** or **RUSBROEK**, **Blessed Jan van** (1293–1381), Flemish Roman Catholic mystic, born in Ruisbroek (in what is now Belgium), near Brussels. He was

vicar of Saint Gudules in Brussels and afterward founded (1349) and became prior of a religious community at Groenendaal, near Waterloo. His mysticism (q.v.), expressed with consummate lucidity and grace in his writings, gained for him the title of "the Ecstatic Doctor"; these writings were known through much of Europe into the 16th century.

Among those people whose work he influenced directly were the Dutch preacher and religious reformer Gerhard Groote (q.v.) and the German mystic Johannes Tauler (1300?–61). Written in Middle Flemish, his books were published in Latin in 1552, in German in 1701, and in English in 1934 (2nd ed., 1944); his masterpiece has been translated (1952) as *The Spiritual Espousals*. Ruysbroeck was beatified by Pope Pius X (see *under* Pius) in 1908.

RUYSDAEL, Jacob van. See RUISDAEL, JACOB VAN.

RUYTER, Michel Adriaanszoon de or **RUITER, Michel Adriaanszoon de** (1607–76), Dutch naval officer, born in Hushing. During the First Anglo-Dutch War (1652–54) he distinguished himself in engagements against the English, while serving under the Dutch admiral Maarten Harpertszoon Tromp (q.v.). In 1653 de Ruyter became vice-admiral of Holland, and during the Second Anglo-Dutch War (1664–67) he defeated the English in a sea battle fought near Dunkirk, France, in 1666. In 1667 de Ruyter conducted a daring expedition up the Medway R. in England, destroying Upnor Castle and burning a number of English ships. As admiral in chief of the Dutch fleet during the Third Anglo-Dutch War (1672–78) he saved the Dutch fleet from destruction by English and French ships during the Battle of Southwold Bay, off the English coast, in 1672. De Ruyter was fatally wounded in a battle against the French fleet near Sicily in 1676. See NETHERLANDS, THE; *History*.

RUŽIČKA, Leopold (1887–1976), Yugoslav-Swiss chemist, born in Vukovar, Yugoslavia, and educated at the Technische Hochschule in Karlsruhe, Germany. He taught at the Eidgenössische Technische Hochschule in Zürich from 1918 to 1926, becoming professor of chemistry in 1923. Between 1926 and 1929 he lectured at the University of Utrecht in the Netherlands, and after 1929 he was professor of chemistry at the University of Zürich. His research in biochemistry involved the synthesis and investigation of the chemical structure of naturally occurring substances, and he is known for his work on musk and sex hormones, particularly testosterone (q.v.); see *HORMONES*. With the German biochemist Adolph Butenandt (q.v.), he

shared the 1939 Nobel Prize in chemistry. He was elected a foreign member of the Royal Society in 1942.

RWANDA, republic in E-central Africa, formerly comprising the N. half of the Belgian trusteeship of Ruanda-Urundi (q.v.). It is bounded on the N. by Uganda, on the E. by Tanzania, on the S. by Burundi, and on the W. by Lake Kivu and Zaire (formerly the Democratic Republic of the Congo). Area 10,169 sq.mi.

THE LAND

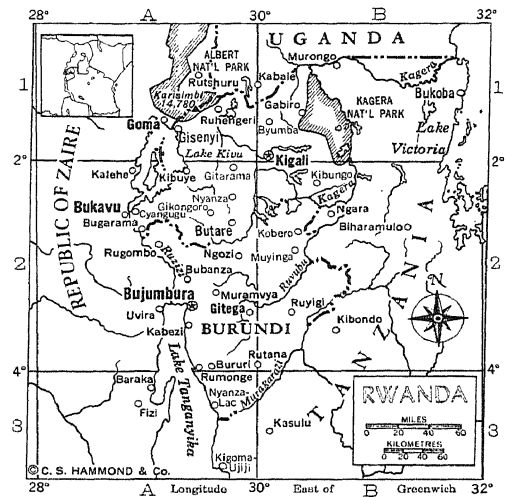
In the center of Rwanda is a hilly plateau averaging about 5600 ft. in elevation. Eastward, toward the Tanzanian border, the land slopes downward to a series of marshy lakes along the upper Kagera R. On the W. side of the plateau is a mountain system averaging 9000 ft. in elevation, forming the watershed between the Nile and Congo river systems. The N. reaches of these mountains contain the Virunga volcanoes, which include Mt. Karisimbi (14,780 ft.). West of the mountains the elevation drops to about 4800 ft. in the Lake Kivu region.

Climate. Rwanda has three main seasons. A short dry season occurs in January. The major rainy season lasts from February through May. May to late September is characterized by dry weather. The average yearly rainfall is 31 in., and is heaviest in the W. and N.W. mountain regions. Wide temperature variations occur because of elevation differences. The average daily temperature in the Lake Kivu area is 73° F. In the mountains in the N.W. frost occurs at night.

Plants and Animals. Forests, once extensive, now are concentrated within the Lake Kivu area. Predominant trees are the eucalyptus, acacia, and oil palms. Wildlife of the region, including the elephant, hippopotamus, crocodile, wild boar, leopard, antelope, and flying lemur, is protected in Kagera National Park.

THE PEOPLE

The population is primarily rural. Most of the people live in family groups dispersed throughout mountainous regions. Three ethnic groups make up the population: the Hutu (85 percent), of Bantu origin; the Tutsi (9 percent), of Hamitic origin; and the Twa (1 percent), a pygmoid people thought to be the last survivors of the original population. The official languages are Kinyarwanda, a Bantu (q.v.) language, and French. The majority of the population is Roman Catholic. The remainder is animist and believes in the existence of *Imana*, the embodiment of Good. Traditional tribal culture has survived and remains almost totally unaffected by external influences. See AFRICAN LANGUAGES; AFRICAN LITERATURE.



INDEX TO MAP OF RWANDA

Cities and Towns

Bugarama	.....A 2
Butare	.....A 2
Byumba	.....B 1
Cyangugu	.....A 2
Gabiro	.....B 1
Gikongoro	.....A 2
Gisenyi	.....A 1
Gitarama	.....A 2
Kibungo	.....B 2
Kibuye	.....A 2

Kigali (cap.)	.....B 1
Nyanza	.....A 2
Ruhengeri	.....A 1

Physical Features

Albert Nat'l Park	.....A 1
Kagera Nat'l Park	.....B 1
Kagera (river)	.....B 2
Karisimbi (mt.)	.....A 1
Kivu (lake)	.....A 1

Population. The population (census 1970) was 3,724,000; the United Nations estimated (1973) 3,984,000. Rwanda is one of the most densely populated countries in Africa, with 392 persons per sq.mi. (U.N. est. 1973). The annual rate of growth averages 2.7 percent and, if maintained, the population will double in about twenty-five years.

Political Divisions and Principal Cities.

Rwanda is divided into ten prefectures, each of which is administered by a prefect who is appointed by the president. The principal cities are Kigali, the capital, with a population (greater city; 1970 est.) of 54,403 and Butare (13,200).

Education. Schooling is free for children aged seven through sixteen. About 25 percent of the adult population is literate. In the early 1970's primary-school enrollment was about 425,000, and secondary and technical schools had about 10,600 students. The National University was opened at Butare in 1963; in the early 1970's it had more than 500 students. A number of Rwandan students attend universities abroad.

THE ECONOMY

Rwanda maintains essentially a subsistence economy. Payments in rural areas are usually in the form of food and shelter, and in urban centers in money and goods.



Rwandan youngsters parade in Kigali during ceremonies marking attainment of nationhood, on July 1, 1962.

United Nations

The country is exposed to soil erosion and drought and subsequent famines. It relies heavily on foreign assistance. Belgium is the main source of economic and technical aid. Of four hydroelectric plants, the main plants are located at Kisenyi, Mururu, and Ntaruka. In the early 1970's annual output of electricity was about 34,000,000 kw hours. Budget figures in a recent year amounted to about \$19,000,000 in revenues and \$24,000,000 in expenditures.

Agriculture. Most of the people are supported by subsistence agriculture. To increase production Belgium introduced new food crops and reforestation projects and opened agricultural experiment stations. With the help of the European Common Market, tea plantations were established. The main cash crop is arabica coffee, of which about 15,000 tons were produced annually in the early 1970's. The livestock population numbers some 740,000 cattle, 600,000 goats, 230,000 sheep, and 60,000 pigs. Because of overgrazing, however, the government is attempting to introduce modern methods of stock raising and feeding.

Mining. Mining is of some importance, but lack of capital has prevented full exploitation of these resources. The chief mineral product is cassiterite, an important source of metallic tin. About 2150 tons were produced annually in the

early 1970's. Beryl, tungsten, and gold are also mined.

Currency, Commerce, and Trade. The currency is the Rwanda franc, consisting of 100 centimes (92.8 Rf equal U.S.\$1; 1973). The National Bank of Rwanda is the issuing bank. Rwanda is an associated state of the European Economic Community (q.v.) and of the Afro-Mauritian Common Organization (OCAM). The chief exports, coffee and cassiterite, are shipped primarily to Kenya and Belgium. Imported from West Germany and Belgium are iron implements, vehicles and fuels, and machinery.

Transportation and Communications. Rwanda has a road network of about 3,700 mi. The one international airport is situated in Kigali. Two monthly periodicals, one bimonthly, and one weekly are published, and two radio stations operate from Kigali.

GOVERNMENT

Rwanda is a republic and executive power is vested in a president. The president is assisted by a council of ministers consisting of twelve members appointed by the president. Legislative power is in the hands of the National Assembly, whose forty-seven members are elected to four-year terms by universal suffrage. The chief political party is the Republican Democratic Movement—Parmehutu (MDR)—founded in 1959. After the 1973 coup d'état, parliament was dissolved and the MDR was suspended.

The armed forces, trained by Belgian advisers, number about 2500.

HEALTH AND WELFARE. Programs have been undertaken by the World Health Organization and United Nations Children's Fund (q.v.) to provide public health services, fight disease, and train medical aides. In November, 1962, a social-security program providing old-age benefits and compensation to workmen was inaugurated.

Local Government. The basic political and administrative unit is the commune; 144 communes have been formed from various tribes and chiefdoms. Communes are presided over by an elected council and a mayor who is elected by the council.

Judiciary. Rwanda has adopted the Belgian judicial system. The supreme court comprises five departments and administers traditional law. A court of appeals administers codified law. Lesser courts have been set up in the prefectures and communes.

HISTORY

The first known inhabitants of Rwanda were the Twa. The Hutu, who probably migrated from the Congo R. basin, were well established by the 15th century when the Tutsi came down from the north and conquered the area. In the feudal society imposed by the Tutsi, the Hutu became a caste of serfs forced into complete subjugation and economic dependency by a Tutsi nobility. The caste system was rigidly upheld, and intermarriage was almost nonexistent. The kings, or mwamis, became the absolute monarchs of the region. *See also* BURUNDI.

In 1858 John Hanning Speke (q.v.) was the first European to visit the area. German explorers subsequently arrived in the 1880's, and Roman Catholic White Fathers established missions in the area. In the 1880's Rwanda (then called Ruanda) and Burundi (then called Urundi) were incorporated into German East Africa. The indigenous rulers maintained good relations with the Germans and, later, with the Belgians, who occupied the country during World War I. After the war the area was mandated to Belgium by the League of Nations (q.v.) and became known as the Territory of Ruanda-Urundi (q.v.). Following World War II Ruanda-Urundi became a trust territory of the United Nations, with Belgium continuing as administering authority.

Independence. When African political consciousness increased after World War II, the Hutu grew more vocal in protesting the political and social inequalities in Rwanda. In 1959 the antagonism between Tutsi and Hutu erupted into violence, and in the following year the

Tutsi king fled the country. A republic was established in January, 1961. In elections held the following September, the Parmehutu Party won a large majority of the seats in the National Assembly, and a 4-to-1 majority voted against the return of the king. Rwanda became an independent nation on July 1, 1962, with Grégoire Kayibanda (1924–), a former journalist and president of the Republican Democratic Movement—Parmehutu (M.D.R.)—as president. The M.D.R. won the elections in 1965 and 1969, and Kayibanda was reelected president.

Continuing tribal warfare brought about an exodus of Tutsi, some 150,000 of whom were still living in neighboring countries in the early 1970's. At the same time thousands of Hutu from Burundi took refuge in Rwanda as a result of tribal strife. In July, 1973, the defense minister, Major-General Juvénal Habyalimana (1937–), led a bloodless coup that ousted the government of Kayibanda. Habyalimana, a Hutu from the north, charged that Kayibanda favored southern Hutu and was trying to monopolize power in the country. Both parliament and the M.D.R. were suspended after the coup.

RYAZAN, city of the Soviet Union, in the Russian S.F.S.R., and capital of Ryazan Oblast, on the Oka R., about 115 miles S.E. of Moscow. It is an important industrial and transportation center; manufactures include agricultural machinery, machine tools, and clothing. Ryazan was founded in the 11th century as Pereyasavl'-Ryazanski and later took the place of the old city of Ryazan, nearby, which was destroyed by invaders in 1237. The city was the seat of the Ryazan bishopric in the 13th century, and became the center of the Ryazan principality in the 15th century. Pop. (1970) 351,000.

RYBINSK, formerly SHCHERBAKOV, city and port of the Soviet Union, in the Russian S.F.S.R., at the confluence of the Volga and Sheksna rivers, 52 miles N.W. of Yaroslavl'. Rybinsk is an important transshipping center between Leningrad and Moscow. The principal industries include shipbuilding and the manufacturing of printing machinery, leather goods, lumber products, and foodstuffs. Rybinsk Reservoir, created in 1941, is the site of a major hydroelectric plant. The city was founded about the 14th century as Rybnaya Sloboda and was named Rybinsk in the late 18th century. In 1946 it was renamed Shcherbakov, after a local Bolshevik leader, but in 1957 it reverted to the name Rybinsk. Pop. (1970) 218,000.

RYDE, city of Australia, in New South Wales, on the Parramatta R., 8 miles N.W. of Sydney, in the metropolitan area. The third-oldest settlement in Australia, it lies in a vegetable-growing

RYDER

area and has shipyards, brickyards, and potteries. To the N., on the Lane Cove R., is Lane Cove National Park. At various times known as Kissing Point, Eastern Farms, and Field of Mars, the area was laid out by former soldiers. Pop. (est.) 80,000.

RYDER, Albert Pinkham (1847–1917), American painter, born in New Bedford Mass., and trained in art at the National Academy of Design, New York City. His formal art training was of short duration, and he was largely self-taught. Ryder painted painstakingly, often reworking his compositions many times, and he executed a total of only about 150 canvases. His paintings, mostly moonlit landscapes and seascapes, are characterized by monochromatic color and strength of mood. Major works include the "Toilers of the Sea" (about 1884), "The Curfew Hour" (1882), and "The Bridge" (1890's), all in the Metropolitan Museum of Art, New York City.

RYE, genus of grasses, allied to wheat and barley, and having spikes that consist of two-flowered spikelets; the florets are furnished with rows of barbs and terminal awns. The varieties of rye are numerous, although much less so than those of other important cereals. Some are best fitted for sowing in autumn, others for sowing in

spring. The former kinds, called winter rye, are the most extensively cultivated, being generally the most productive. Bread made of rye, black bread, is much used in the north of Europe. It is of dark color, more laxative than that made of wheat flour, and, perhaps, rather less nutritious. Rye crop is used mainly for livestock feed in mixtures with other grains. It is also used in the making of alcoholic beverages. Rye whiskey (q.v.) is produced from a mash containing more than 50 percent of rye grain. The straw of rye is tougher than that of any other corn plant, and is much valued for straw plait. Rye produced in the United States in the early 1970's averaged 1,426,180 short tons annually. World production of rye in the same period totaled more than 32,000,000 short tons per year.

RYE, city of New York, in Westchester Co., on Long Island Sound, about 21 miles N.E. of central Manhattan. Primarily a residential area, the city has some manufacturing. Rye has a fine beach and is the site of an amusement park. Settled in 1660, it was incorporated as a village in 1904 and chartered as a city in 1942. Pop. (1960) 14,225; (1970) 15,869.

RYE HOUSE PLOT, name given to a conspiracy organized in 1683 by members of the Whig Party (see Whig) in England for the assassination of the English king Charles II and his brother the duke of York, later James II (q.v.), King of England. The victims were to be killed as they were passing a place known as Rumbold's Rye House on the road between London and Newmarket. They did not make the journey on the expected day, however, and the plot was revealed. Many of the conspirators escaped but the plot was used by the government as an excuse to arrest several Whig leaders, notably Lord William Russell (1639–83) and Algernon Sidney (q.v.). Although there was little evidence that they were involved in the plot, Russell and Sidney were executed for treason. James Scott, Duke of Monmouth (q.v.), natural son of Charles II, may have been more deeply implicated; he was pardoned but excluded from the royal court.

RYLE, Sir Martin (1918–). English radio astronomer and Nobel laureate.

Ryle was born in Brighton, Sussex, on Sept. 27, 1918, the son of an Oxford University professor of medicine. He was educated at Oxford and after World War II held a fellowship at Cavendish Laboratory, Cambridge University. He served as a university lecturer there (1948–59), then was appointed professor of radio astronomy; he has also been director of the Mullard Radio-Astronomy Observatory at Cambridge since 1957. A major figure in the development of

"Dakold", a newly developed variety of rye under cultivation in Canada.

National Film Board of Canada



radio astronomy, Ryle made studies of radio waves coming from the stars and the sun and directed the compilation of the Cambridge catalogues of radio sources, which provided the basis for the discovery of quasars (q.v.). He was knighted in 1966 and named Astronomer Royal in 1972. In 1974 Ryle was awarded the Nobel Prize in physics for his development of aperture synthesis, a method of using two small telescopes to pick up distant radio signals, extending man's view of the universe to several billion light-years away. He shared the prize with the English physicist Antony Hewish (q.v.).

RYSWICK, PEACE OF, pact signed on Sept. 20, 1697, at Ryswick, a Dutch village on the outskirts of The Hague. The treaty ended the war between Louis XIV (q.v.), King of France, and the Grand Alliance (q.v.), a coalition including England, Spain, the Netherlands, and the Holy Roman Empire (q.v.). Louis agreed to recognize William of Orange as William III (q.v.), King of England, and was forced to return most of the territory captured during the war. The Dutch received favorable trading terms with France and the right to hold certain fortresses in the Spanish Netherlands. See KING WILLIAM'S WAR.

RYUKYU ISLANDS (Jap. *Nansei-Shoto*), chain of islands in the Pacific Ocean, extending 650 mi. from s. Japan to the N. tip of Taiwan.

The Ryukyus consist of three major groups: the Amami Islands in the N., the Okinawa Islands in the central area, and the Sakishima Islands to the S. The larger islands are volcanic with mountainous terrain, and most of the smaller islands are flat coral formations. The principal agricultural products are sugarcane and sweet potatoes, and manufactures include Panama hats, textiles, and pottery. The leading exports are black sugar and canned pineapples. Naha, on the island of Okinawa, is the largest city.

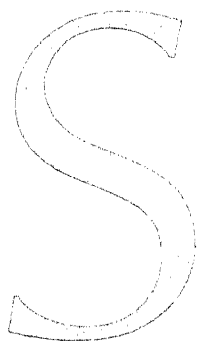
Prior to the conclusion of World War II, the islands formed the Okinawa Prefecture of Japan. During the postwar period the United States occupied and administered the islands, declaring the residual sovereignty of Japan over the islands in 1951. In 1953 the Amami Islands were returned to Japan and incorporated into Kago-

shima Prefecture. Under an agreement reached in 1971, the remaining U.S.-occupied islands were returned to Japan in 1972.

The people of the Ryukyu Islands are related to the Japanese racially, culturally, and linguistically, and their history has been strongly influenced by both China and Japan. The Chinese first invaded the islands in the 7th century, and in the 14th century China established a supremacy that lasted for five centuries. Japan invaded the Ryukyus in 1609, and joined China in requiring tribute money. In 1879 Japan dethroned the ruler of the islands and annexed the Ryukyus as the Okinawa Prefecture; China protested, but the Japanese remained in control of the entire chain. In April, 1945, the island of Okinawa (q.v.) was the site of a famous World War II victory of U.S. forces over the Japanese; see WORLD WAR II: *Decisive Phases of the War Against Japan: Battles for Iwo Jima and Okinawa*. Area, about 1800 sq.mi.; pop. (1971 est.) 953,000.

RYUN, James Ronald (1947–), American athlete, born in Wichita, Kans., and educated at the University of Kansas. In 1964, shortly after his seventeenth birthday, Ryun became the first high-school boy to run one mile in less than four minutes. Two years later, besides setting two American records, he established world records of 1:44.9 minutes for the outdoor 880-yard or half-mile run and 3:51.3 minutes for the mile run. In 1967 he surpassed his own time for the mile, running it in 3:51.1 minutes, and set a world record of 3:31.1 minutes for the 1500-meter run. Ryun competed in the 1964, 1968, and 1972 Olympic Games (q.v.). He became a professional in 1973 and retired in 1976.

RZESZÓW, city in Poland, and capital of Rzeszów Province, on the Wisłok R., 90 miles E. of Cracow. The city manufactures transportation equipment, machinery, bricks, cement, iron products, and lumber, and manganese deposits lie nearby. Rzeszów has a provincial museum of folk art, a theater, a school of engineering, and a 17th-century baroque church. The city was founded in the 14th century. It passed to Austria in the 1772 partition of Poland and again became Polish in 1919. Pop. (1972 est.) 125,000.



S, nineteenth letter and fifteenth consonant of the English alphabet. It first appeared in its modern form in the Roman alphabet, as the equivalent of the Greek letter *sigma*. The Greek character was derived from a Phoenician letter corresponding to the Hebrew *sin* or *shin*; the Phoenician letter was in turn derived from an Egyptian hieratic character based on the hieroglyph for an inundated garden. The distinctive forms taken by the character during its history may be summarized as follows:

Roman	Early Greek	Phoenician	Egyptian Hieratic	Egyptian Hieroglyphic
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The *s* sound is technically known as a sibilant consonant, which may be either voiceless or voiced. It is normally produced in English by bringing the tip of the tongue close to the upper gum and sending the breath through the resultant narrow opening. Such a sound is formed by the rubbing or hissing of the breath passing through the constricted oral passage, and is often called a fricative or spirant consonant. The voiceless *s* sound occurs in such words as *sing*, *mast*, and *horse*; the voiced *s*, having the phonetic value of *z*, often occurs at the end of words and sometimes between vowels, as in the words *tails*, *moves*, and *preserve*. The letter *s* is occasionally given the phonetic value of *sh* or *zh* in words such as *sure* and *treasure*; it is silent in a few words, including *aisle*, *isle*, and *debris*. In combination with the letter *h*, the letter *s* forms the digraph, or single speech sound, of *sh*, exemplified in the words *shadow*, *shall*, and *ship*.

As an abbreviation, the capital *S* is used for *Sabbath*, *Sunday*, *September*, and *Saxon*. In chemistry it represents the element *sulfur*; in physics it stands for *slope*, *surface*, and *stress*;

and in mathematics it stands for *scalar*. Capital or lowercase *S* is used for the direction *south*, and for *saint*, *school*, *senate*, *socialist*, *society*, *soprano*, and *steel*. Lowercase *s* stands for *second*, *series*, *set*, *sign* or *signed*, *silver*, *solo*, *son*, *spherical*, *steamer*, *sun*, and *surplus*; in physics it stands for *linear distance* and for *shear*.

As a symbol, the capital or lowercase *S* is used to indicate the eighteenth or, when *J* is the tenth, the nineteenth in a class, order, group, or series. In Roman numerals the capital *S* represents the numbers 7, 70, or, in the form S , 70,000. The capital letter is used as a qualifying noun in compound words describing anything having the shape of the capital *S*, as an *S curve*.

M.P.

SAADI or **SADI**, real name MUŠİEH-UD-DİN (1184?-1291), Persian poet, born in Shiraz. He traveled widely in North Africa and India and made several pilgrimages to Mecca (q.v.). After returning to Shiraz he wrote his most famous works, *Būstān* ("Fruit Garden", 1257), a verse collection of fables, maxims, and histories, and *Gulistān* ("Rose Garden", 1258), a book of maxims in verse and prose. His other works include *Dīwān*, a collection of his finest lyrics. Saadi wrote in both Persian and Arabic; he was admired for his wisdom and for the elegance of his poetry. His tomb in Shiraz (q.v.) is still one of the chief sights of the city.

SAALE, river of Germany. It rises in the Fichtelgebirge of N. Bavaria and flows generally S through Thuringia to join the Elbe R. 18 miles S of Magdeburg. Ancient towns along its course include Jena, Naumburg, and Halle. The Saale R. is about 265 mi. long and is navigable as far as Naumburg.

SAAR (fr. *Sarre*), river of France and Germany, tributary stream of the Moselle R. It rises in the Vosges Mts. of S. France, and flows generally S across the French department of Moselle, entering German territory near Sarreguemines. With

in Germany it flows N.W. through the coalfields of the Saarland, and joins the Moselle R. 5 miles S.W. of Trier. The Saar is 150 mi. long and can be navigated between Sarreguemines and Völklingen.

SAARBRÜCKEN, city in West Germany, and capital of Saarland State, on the Saar R., 100 miles S.W. of Frankfurt. It is the center of one of the great coal-mining regions of the world. The city has important iron and steel industries; manufactures include optical instruments, lime, and cement. Located near the French border of Germany, Saarbrücken is the intersection of German road and rail communications with France, the Netherlands, Belgium, Switzerland, and Italy. Heavily bombed during World War II, it was restored by the late 1950's. Pop. (1970) 128,300.

SAARINEN, family of well-known Finnish-American architects.

Gottlieb Eliel Saarinen (1873-1950), Finnish architect, born near Helsingfors. With two associates he designed the Finnish Pavilion at the French exposition (see EXHIBITIONS AND EXPOSITIONS) in Paris in 1900. Saarinen emigrated to the United States with his family in 1923. After his son Eero joined his architectural firm in 1936, the two men designed a number of buildings together, including the Smithsonian Art Gallery (1939) in Washington, D.C., and the music shed (1940) at Tanglewood in Lenox, Mass. From 1932 to 1948 Saarinen served as president of the Cranbrook Academy of Art in Bloomfield Hills, Mich.

Eero Saarinen (1910-61), American architect, born near Helsinki, Finland, and naturalized a U.S. citizen in 1940. He was educated at the Yale School of Fine Arts; and after traveling in Europe for two years, he joined his father's company in 1936. As his first independent commission, he designed a stainless steel arch for the Jefferson Memorial, Saint Louis, Mo., in 1948; it was con-

structed in 1965 as the Gateway Arch of the Jefferson National Expansion Memorial National Historic Site (q.v.). In 1950 he opened his own office. His many academic and commercial structures are notable for achieving functionalism by the use of soaring curved lines.

Among other famous structures designed by Eero Saarinen are the chapel and auditorium at Massachusetts Institute of Technology (completed in 1955), Cambridge, Mass.; the U.S. embassy (1960) in London, England; and the Vivian Beaumont Theater (1965) at the Lincoln Center for the Performing Arts (q.v.) in New York City. Saarinen's furniture designs were also well received, especially his pedestal-based tables and chairs.

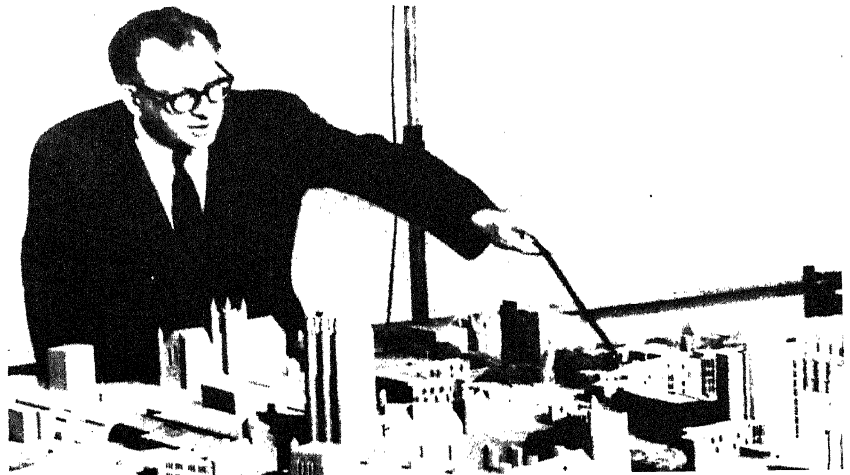
His wife Aline Bernstein Saarinen (1914-72), born in New York City, and educated at Vassar College and the Institute of Fine Arts of New York University, was a well-known art critic and television personality. She is the author of a book on art collectors entitled *The Proud Possessors* (1958).

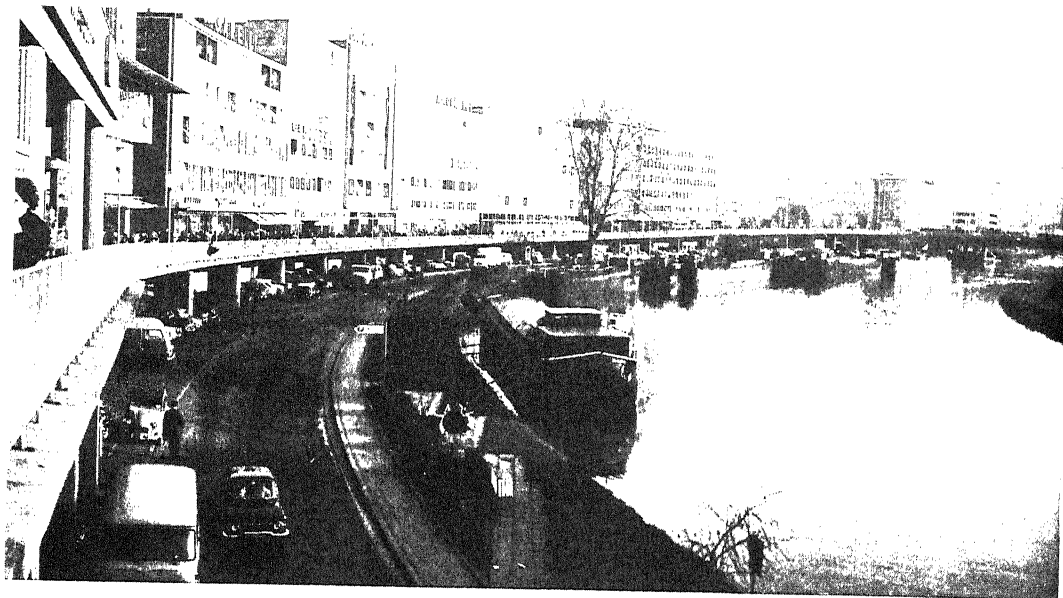
SAARLAND, State of West Germany, bounded on the N. and E. by the State of Rhineland-Palatinate, on the S. by France, and on the W. by France and Luxembourg. The capital and largest city is Saarbrücken. Other major cities are Neunkirchen, Völklingen, Sulzbach, and Dudweiler. Saarland is made up of rolling hills, cut in a S.E. to N.W. direction by the Saar R. Area, 991 sq.mi.; pop. (1970 est.) 1,127,400.

The Saar Valley, which contains enormous coal deposits, is the heart of the State's economy. The main economic activities are coal mining and steel processing. Other important industries are the production of chemicals, machinery, glass, and ceramics. Agriculture is of minor importance. The chief crops are cereals and potatoes. About one third of the State is covered with forests, and lumbering is important.

Eero Saarinen

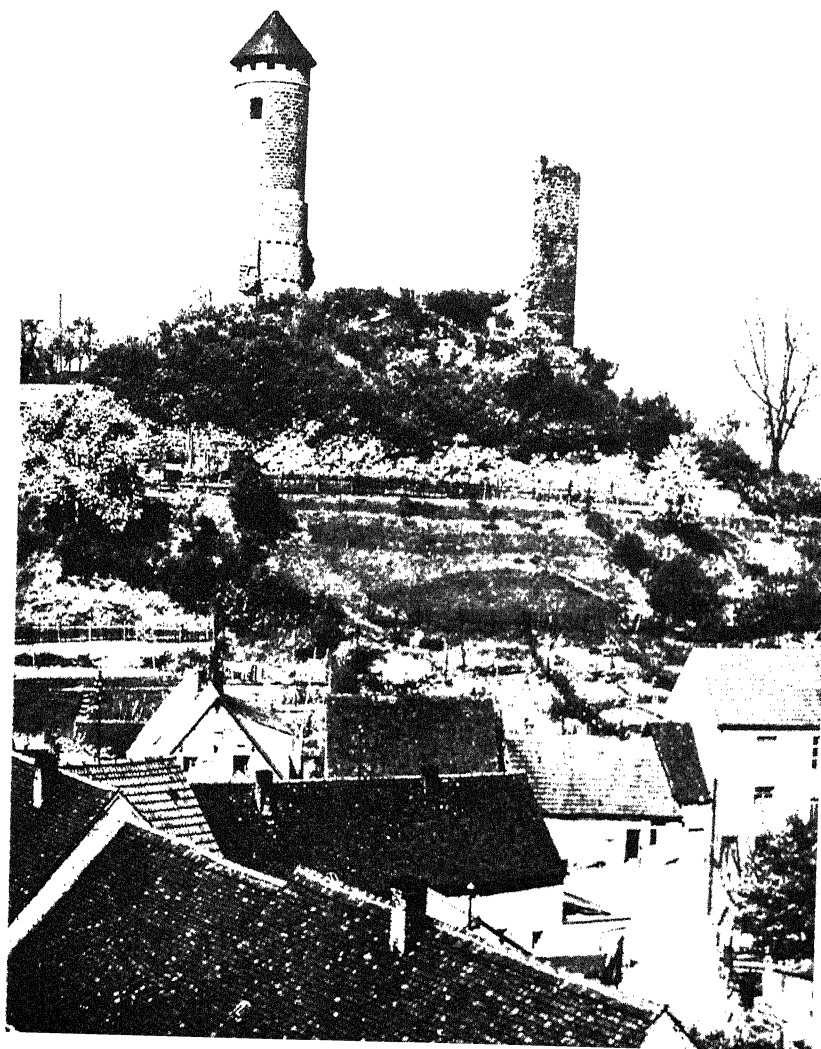
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Above: Berliner Promenade, a major shopping area of Saarbrücken, the capital of Saarland. Left: Ruins of a castle on the road from Saarbrücken to Kaiserslautern, in the State of Rhineland-Palatinate.

German
Information Center



Under the 1947 constitution, the State is governed by a cabinet, headed by a minister-president. The cabinet is responsible to a popularly elected diet.

History. The Saar area was incorporated into the Roman Empire in the 1st century B.C., and after the fall of the empire, the region came under Frankish control. In 925 it became part of the Holy Roman Empire (q.v.), but French influence continued to be strong. From 1381 to 1793 the counts of Nassau-Saarbrücken were the main local rulers. Often a prize contended for by its stronger neighbors, the area came under French domination in the 16th century and was incorporated by France in the 1680's. France was forced to relinquish the Saar in 1697, but from 1793 to 1815 was again in control of the region. After 1815 much of the area was part of the Prussian Rhineland province. During the 19th century the coal and iron resources of the region were developed.

Under the Treaty of Versailles (see VERSAILLES, TREATY OF) following World War I, the Saar was organized as a single political unit, the Saar Territory. It was made up of 573 sq.mi. of the Prussian Rhineland and 164 sq.mi. of Bavarian Palatinate. The coal mines in the territory were made the exclusive property of France for a period of fifteen years as compensation for the destruction of French mines during the war. The treaty also provided for a plebiscite, at the end of the fifteen-year period, to determine the territory's future status. It was ruled by an international commission appointed by the League of Nations (q.v.) and assisted by an elected consultative council. In a plebiscite held on Jan. 13, 1935, more than 90 percent of the electorate voted for reunification with Germany. On March 1, the territory rejoined Germany as the Saarland Province.

The Saarland was heavily bombed in World War II and made part of the French Zone of Occupation in 1945. In 1946 the area, enlarged by 600 sq.mi. of territory taken from the Prussian Rhineland Province, was made a separate zone, with a customs barrier between it and the rest of Germany. Throughout the late 1940's and early 1950's, the French tried to make the Saar a separate state. On Jan. 3, 1948, the Saar was granted self-government, and in 1950, it became an associate member of the Council of Europe (q.v.). In 1956 the Saar government requested early unification into West Germany. A Franco-German treaty provided for reunification, and on Jan. 1, 1957, the Saar, under the name Saarland, became a State in West Germany. The treaty also provided for economic integration

with West Germany. France was, however, guaranteed 90,000,000 tons of coal from the region over a twenty-five year period; 24,000,000 tons to be sold at cost price.

SAAVEDRA LAMAS, Carlos (1878–1959), Argentine statesman, born in Buenos Aires, and educated at the University of Buenos Aires. He held many posts, both elective and appointive, in local and national governments of Argentina. During his term as foreign minister (1932–38), he was largely instrumental in ending (1935) the war between Bolivia and Paraguay over the Gran Chaco (q.v.), a borderland between the two nations, and subsequently was awarded the 1936 Nobel Peace Prize. A leader in inter-American affairs and an active supporter of the League of Nations (q.v.), he served (1936) as president of the League assembly.

SABA, ancient kingdom of Arabia (q.v.). See SHEBA.

SABAEANS or SABEANS. See SHEBA.

SABAH, State of Malaysia, prior to 1963 the British crown colony of North Borneo. Together with Sarawak it comprises East Malaysia; see BORNEO; MALAYSIA. Occupying the northernmost part of the island of Borneo, it is bounded on the N.W. and N. by the South China Sea, on the N.E. by the Sulu Sea, on the S.E. by the Celebes Sea, on the S. by Kalimantan (Indonesian Borneo), and on the W. by Sarawak. Its total area, including the island of Labuan, is about 29,390 sq.mi., with a coastline of about 900 mi.

Sabah is extremely mountainous, the only lowlands of importance being confined to the coastal region. A number of broad upland valleys traverse the interior. The highest peaks are found in the W. part of the State; Mt. Kinabalu (13,455 ft.) is the highest summit on the island. Both the coastal belt and the mountain slopes are heavily forested. Streams are numerous and because of the rugged terrain are generally swift and interrupted by rapids. The Kinabatangan R. is navigable by light-draft vessels for about 120 mi. inland from the Sulu Sea. The Labuk and Padas rivers are also important waterways. The coastline is indented by several large embayments and natural harbors. Tropical climatic conditions prevail throughout most of Sabah. Average annual precipitation ranges from 60 in. to 175 in.

Kota Kinabalu, formerly Jesselton, the capital, had a population (1970) of about 42,000. Other important towns include Sandakan (42,000) and Tawau (24,184). The total population (1970) of 655,295 is composed of indigenous tribes (421,962) and Chinese (140,969), as well as Malays, Eurasians, Europeans, and others. The main

SABATIER

tribes are Dyak peoples (see DAYAKS) and include the Dunsuns, Bahaus, and Bruneis (agricultural and fishing groups), Muruts (hill tribes), Suluks (mostly seafaring people), and the largest group, the Kadayans (primarily agricultural people).

The forests yield considerable timber, rubber, rattan, and other products. Extensive mineral deposits exist, including petroleum, coal, gold, copper, tin, antimony, diamonds, iron, and sulfur; but exploitation is hampered by inadequate transportation facilities. Agriculture, forestry, and fishing are the leading industries. Rubber, timber, hemp, dried and salted fish, tobacco, and copra are the main exports. Annual export income was valued at more than \$174,500,000 in the early 1970's.

Executive authority is vested in the head of state (called the Yang di-Pertua Negara) who is advised by a state cabinet. The legislative assembly consists of a speaker, thirty-two elected members, and not more than six nominated members.

History. The region came under British control in 1877 when a British trading syndicate (later called the British North Borneo [Chartered] Company) obtained concessions from the sultans of Brunei and Sulu and other rulers in the region. The British North Borneo Company, under a royal charter granted in 1881, undertook the administration of the region. In 1888 North Borneo was made a British protectorate, but the company retained its administrative powers until July 15, 1946, when British North Borneo was proclaimed a crown colony. During World War II the region was occupied by Japanese forces. When the Federation of Malaysia came into existence on Sept. 16, 1963, British North Borneo, renamed Sabah, became a member State.

SABATIER, Paul (1854–1941), French chemist, born in Carcassonne, and educated at the École Normale in Paris. After teaching chemistry at the lycée in Nîmes and physics at the University of Bordeaux he became professor of chemistry at the University of Toulouse in 1883. He became famous for his work on the application of finely divided metals as catalytic agents in organic syntheses. Sabatier shared the 1912 Nobel Prize in chemistry with the French chemist Victor Grignard (q.v.). He also received the Davy Medal of the Royal Society in 1915 for his accomplishments. His most famous work is *La Catalyse en Chimie Organique* ("The Catalyst in Organic Chemistry", 1913).

SABATINI, Rafael (1875–1950), Italian-British author of historical-romance novels, born in

Iesi, Italy. Of Italian and British descent, he received his schooling in Switzerland and Portugal before settling in England as a young man and developing his craft as a storyteller. His period novels, turned out at a prolific rate, are highly imaginative and dramatic in plot but also realistic in their attention to historical detail.

His first novel, *The Tavern Knight*, appeared in 1904, and was followed by more than forty other picaresque adventure tales. Among the best-known are *The Sea Hawk* (1915), *Scaramouche* (1921) and *Captain Blood* (1936). Many of his novels have been made into "swashbuckling" motion pictures. He also wrote several historical works, including *The Life of Cesare Borgia* (1912) and *Torquemada and the Spanish Inquisition* (1913).

SABBATAI ZEBI (1626–76), Jewish mystic and false messiah (q.v.), born in Smyrna (now İzmir, Turkey). Proclaiming himself the messiah in 1648, he was able to convince many thousands of Jews, particularly in eastern Europe, Asia, Africa, and England of the justness and righteousness of his claim. Honors and wealth were lavished upon him. Becoming a threat, however, to Mohammed IV, Sultan of Turkey (1641–91), he was imprisoned. After some months of confinement, during which his followers made it possible for him to live in undiminished splendor, he was terrified into recanting and converting to Islam (q.v.). The name is also spelled Zevi.

SABBATH, in religion, designation given to various days of the month or week. The Babylonians (see BABYLONIA) called the fifteenth day of the month the Sabbath. The early Hebrews (q.v.) seem to have followed the same practice, but the Jews (q.v.) called the seventh day of the week the Sabbath. Christians usually consider Sunday (q.v.), the first day of the week, to be the Sabbath, although some groups, for example, the Seventh-day Adventist Church (q.v.), follow the Jewish custom. See also CHRISTIANITY; JUDAISM.

The Sabbath is observed with special customs in each society or religious group mentioned. It is an occasion for feasting, as in Pesach (q.v.) or Passover. This feast is celebrated on the fifteenth day of the Jewish month of Nisan (approximating July). Some Biblical scholars see (Lev. 23:15) a connection with the Sabbath and the full moon; and the new moon and the Sabbath are frequently associated, as well. Concerning the manner in which the Sabbath on the fifteenth gave place to a weekly Sabbath, only surmises are possible.

Other observances followed on the Sabbath derive from Biblical injunctions. Jews and Chris-

tians are instructed to rest and to refrain from certain types of work. These instructions are based on several Biblical passages. In Genesis, God rests after his work of creation: "Thus the heavens and the earth were finished . . . And on the seventh day God ended his work . . . ; and he rested on the seventh day . . ." (Gen. 2:1-2). Later, this is cited as a reason for men to do the same (Exod. 20:11). Another reason proffered is to commemorate liberation from slavery in Egypt (Deut. 5:15). These two last-cited passages are suggested by many scholars to be later additions, and they believe the original form of the Fourth Commandment (see DECALOGUE) to be: "Remember the day of the Sabbath to keep it holy".

Strictness of Sabbath observance among Jews and Christians was characteristic of early times and of the Middle Ages (q.v.); among the orthodox it continues today. Most Christian churches have transferred to the first day of the week many features of the Jewish Sabbath. See BLUE LAWS; PRAYER, JEWISH.

SABER. See SWORD.

SABER-TOOTHED TIGER, common name applied to any of several extinct mammals of the Cat family (see FELIDAE) belonging to several genera, particularly *Machairodus* and *Smilodon*, of the subfamily, Machairodontinae. Fossil remains of various species of saber-toothed tiger have been found in geological strata indicating that the mammals lived in the Old World and New World from the Oligocene to the Pleistocene Epoch. At their evolutionary peak they resembled tigers in general appearance, but they had a shorter tail and more massive and shorter legs and feet. The most striking feature of the extinct animal was the development of the upper canine teeth, which in the most highly evolved species protruded 7 in. or more below the lower jaw and were shaped like sabers. Some scientists believe that the animal became

extinct because the overdeveloped canines outgrew their usefulness and became a hindrance in procuring food.

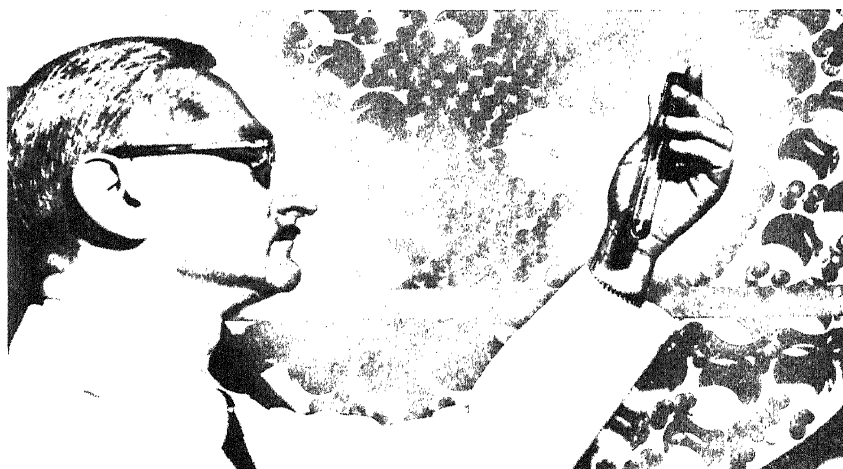
SABIN, Albert (Bruce) (1906-), American microbiologist, born in Bialystok, Russia (now in Poland). He came to the United States in 1921 and was naturalized in 1930. In 1931 he received an M.D. degree from New York University. He was at the Rockefeller Institute (now Rockefeller University) from 1935 to 1939. In 1939 Sabin joined the staff of The Children's Hospital Research Foundation and the College of Medicine of the University of Cincinnati, Ohio. In 1960 he was appointed the first university distinguished service professor. During the 1950's Sabin developed an oral, attenuated, live-virus poliomyelitis vaccine. The safety and effectiveness of the vaccine was established in large-scale field tests in many parts of the world from 1958-60. In 1960 this Sabin vaccine was approved by the U.S. government, and it has been used all over the world. Since 1961 Sabin has been engaged in studies on the role of viruses in cancer. In addition to his research in the U.S., in 1969 he was appointed president of the Weizmann Institute of Science in Rehovot, Israel. See POLIO-MYELITIS.

SABINE, river of Texas and Louisiana. The Sabine rises in N.E. Texas and flows S.E. to the Louisiana boundary, then S., forming the State line between Texas and Louisiana, until it empties through Sabine Lake and Sabine Pass into the Gulf of Mexico. The river is 578 mi. long and is navigable S. of Orange, Tex.

SABINES, ancient people of central Italy, in close contact with early Rome. They lived in the mountainous country E. of the Tiber R., N. of the Latins and Aequi, and S. of the Umbrians and Picenes. The Sabines probably spoke Oscan, the chief language of central Italy, and belonged to the Sabellian group of Italic peoples. They were well known for their religious practices, which

Albert Sabin

National Foundation for
Infantile Paralysis





Sable, *Martes americana*

Edwin C. Park
National Audubon Society

influenced many Roman customs. The account of the capture of the Sabine women by the followers of Romulus (q.v.), first king of Rome, is legendary. It is widely believed that the Sabines settled on the Quirinal and Esquiline hills and subsequently joined with another people on the Palatine Hill to form Rome. In 290 B.C. the Sabines were conquered by the Roman general Manius Curius Dentatus (fl. 290–272 B.C.), and in 268 B.C. they were granted full Roman citizenship. They were the parent stock of the Samnites (q.v.).

SABLE, fur-bearing animal, noted for yielding the most valuable pelt of the family Mustelidae. Two species are found in North America, *Martes americana* and *M. pennanti*; the former is usually known as the pine marten and the latter as the fisher; see MARTEN. The Siberian sable is about 18 in. long, excluding the tail. The fur is mainly dark brown, but grayish-yellow on the throat with spots of the same color scattered on the sides of the neck. The whole fur is extremely lustrous. See FUR.

SABLE, CAPE. See CAPE SABLE.

SABLE ISLAND, low-lying crescent-shaped island of the Atlantic Ocean, c. Nova Scotia, Canada, about 290 km (180 mi.) E. of Halifax. The exposed part of a long sand shoal, the treeless island is about 32 km (20 mi.) long and 1.6 km (1 mi.) wide. Called the "graveyard of the Atlantic", it is a major hazard to navigation, and more than 200 shipwrecks have occurred there since 1583. Ships are now alerted by two lighthouses (built in 1873) and a radio warning system. Sable Island was briefly settled (1598–1603) by a small French colony. It is now inhabited by only a few families and some wild horses.

SAC. See FOX (North American Indian tribe).

SACAGAWEA, or SACAIAWEA or SAKAJAWEA (1787–1812 or 1884), Shoshoni Indian woman, born probably in Idaho. She was captured by

members of another tribe in 1800 and sold to a Canadian trapper named Toussaint Charbonneau, one of whose wives she became. In 1804 Charbonneau was hired as an interpreter and guide for the western expedition of the American explorers Meriwether Lewis (q.v.) and William Clark (see under CLARK), but it was Sacagawea who proved invaluable to the explorers during their passage through western Montana and Idaho. One of the two Indian wives of Charbonneau died in 1812 and was thought to be Sacagawea; however, an old Indian woman who died on a reservation in 1884 also claimed to be Sacagawea and displayed considerable knowledge of the Lewis and Clark expedition. Of the many memorials to Sacagawea, the most famous is a statue in Washington Park, Portland, Ore. See LEWIS AND CLARK EXPEDITION.

SACCHARIN, synthetic, white, crystalline powder, of formula $C_6H_4CONHSO_2$, which in its pure state is 550 times as sweet as sugarcane (q.v.). In its commercial form, saccharin is estimated to have a sweetening power 375 times that of sugar (q.v.). It is prepared from toluene (q.v.); the sweet taste of the substance was discovered accidentally in the course of investigations of toluene derivatives. When moderately large amounts of saccharin are dissolved in water, the solution has a bitter taste, the sweetness being evident only in dilute solutions. Saccharin is not digested by the body and has no food value. It is used in place of sugar by persons suffering from diabetes (see DIABETES MELLITUS), and also by persons on weight-reducing diets. See also CHEMICAL COMPOUNDS, SYNTHETIC.

SACCHAROSE. See SUGAR.

SACCO AND VANZETTI, CASE OF, Massachusetts murder case, famous throughout the world, lasting more than seven years (1920–27). The accused were shoe worker Nicola Sacco (1891–1927) and fish peddler Bartolomeo Vanzetti (1888–1927), Italian immigrants who had arrived in America in 1903, the crimes with which they were charged were the murders of a paymaster and a guard and the theft of more than \$15,000 from a shoe factory in South Braintree on April 15, 1920.

The trial took place in Dedham between May 31 and July 14, 1921. The case of the State was based primarily upon two facts: Sacco possessed a pistol of a type used in the murders, and the accused when arrested were at a garage attempting to claim an automobile connected with the South Braintree crimes by witnesses. What many regarded as inadequate evidence played a large part in the trial. Also, there was contradictory testimony from witnesses. The

judge, Webster Thayer, and the jurors were accused of bias. When the jury returned a verdict of guilty, an outcry arose from socialists, radicals, and many prominent intellectuals throughout the world, claiming that the two men had been condemned because they were guilty only of being immigrants and outspoken anarchists; see ANARCHISM. Both men had in fact been under investigation by the United States Department of Justice for their radical activities long before their arrest.

During the next six years, motions to submit new evidence and appeals for a new trial were frequently made and denied. In 1925, Celestine Madeiros (d. 1927), a man condemned to death for another murder, confessed to having been a member of a gang that committed the South Braintree crimes. In April, 1927, however, the death sentence was pronounced for Sacco and Vanzetti. Appeals to the governor of Massachusetts, Alvan Tufts Fuller (1878–1958), induced him to appoint a committee composed of the president of Harvard University, Abbott Lawrence Lowell (see *under* LOWELL), the president of the Massachusetts Institute of Technology, Samuel Wesley Stratton (1861–1931), and a former judge, Robert Grant (1852–1940), to investigate the trial and its aftermath. On Aug. 3, the governor announced that, in accordance with the recommendation of the committee, he would sustain the death sentences. Several stays of execution followed, but on Aug. 23, 1927, the two men were electrocuted.

Plays, operas, poems, and many books have been written about the case, usually depicting Sacco and Vanzetti as martyrs and their case as a classic miscarriage of justice.

SACHS, Hans (1494–1576), German poet and dramatist, born in Nuremberg. He was apprenticed to a shoemaker in 1509, and later joined the guild of the *meistersinger* (q.v.), a group of poets and musicians of the artisan and trading classes. As a journeyman cobbler Sachs traveled in southern Germany and the Rhine country, and he met with *meistersinger* guilds in many towns. In 1517, by having a tune of his approved, he became a master in the Nuremberg guild, and in 1519 he was made a master shoemaker. Sachs was sympathetic to the Reformation (q.v.); his most famous poem, *The Nightingale of Wittenberg* (1523), was a defense of the German religious reformer Martin Luther (q.v.). He was a prolific poet, producing over 6000 songs, plays, and narrative poems, and his works are known for their lively humor and vivid representations of everyday life. Hans Sachs is the central figure of the opera *Die Meistersinger von Nürnberg* (1867) by the German composer Richard Wagner (q.v.).

SACHS, Nelly (1891–1970), German-Swedish poet, born in Berlin. She began to write poetry at the age of seventeen. Her first book was unsuccessfully published in 1921 and some of her poems appeared in periodicals during the 1920's. In 1940 she left Germany, then governed by the National Socialist Party, to live in Sweden. Miss Sachs shared the 1966 Nobel Prize in literature with the Israeli writer Shmuel Yosef Halevi Agnon (q.v.). The theme that recurs throughout her later writings is profoundly Jewish, drawing lyrical inspiration from the tragedies of Jewish history. Her *Selected Poems*, a collection of her verse translated from the original German into English, was published in 1968.

Nicola Sacco (right) and
Bartolomeo Vanzetti,
during their trial in 1921.

UPI



SACKVILLE

This volume included the verse play *Eli*, written in 1943 and produced on the German radio in 1958 and in the theater at Dortmund, West Germany, in 1962.

SACKVILLE, name of an English family possessing the earldom and dukedom of Dorset. The most important members were the following.

Thomas Sackville, 1st Earl of Dorset and Baron Buckhurst (1536–1608), poet and diplomat, born on the estate of Buckhurst Park, Sussex. In 1553 he settled in London, and after attending the Inner Temple he became a barrister in 1558. From 1558 to 1567 he was a member of Parliament; in the latter year he was knighted and created Baron Buckhurst. Sackville's first important poems were the "Induction" and the "Complaint of Henry, Duke of Buckingham". Both works appeared in the 1563 edition of *A Mirror for Magistrates*, a collection of poems by various writers that takes the form of lamentations by the ghosts of famous men who were ruined by ambition. Sackville's "Induction" stands at the beginning of the work and describes the poet's journey to the infernal regions, where he encounters figures representing forms of suffering and terror. The poem is noted for the power of its allegory, and for its somber stateliness of tone. Sackville's other important work, written in collaboration with the English poet Thomas Norton (q.v.), was *The Tragedy of Gorboduc* (1565), the first English drama in blank verse (q.v.). The play deals with the consequences of political rivalry. Sackville carried out a number of diplomatic missions for Elizabeth I (q.v.), Queen of England, and in 1586 he was appointed to announce the sentence of death pronounced upon Mary, Queen of Scots (q.v.). He became lord high treasurer in 1599, and in 1604 was created earl of Dorset.

George Sackville Germain, 1st Viscount Sackville (1716–85), soldier and statesman, son of Lionel Cranfield Sackville, 1st Duke of Dorset (1688–1765), educated at Trinity College, Dublin. He became an officer in the British army, served with distinction in the War of the Austrian Succession (see SUCCESSION WARS), and was wounded at the Battle of Fontenoy. In 1758, during the Seven Years' War (q.v.), Sackville succeeded to the command of the British forces fighting in alliance with the Germans against the French. Later in the same year, at the Battle of Minden, he disobeyed the orders of his commander by refusing to lead a cavalry charge that would have insured a decisive allied victory. He was court-martialed in 1760 and was dismissed from the military service. In 1775 Sackville be-

came colonial secretary under the British prime minister Frederick North (q.v.). In this capacity he was directly responsible for the conduct of British policy during the American Revolution (q.v.).

SACO, city of Maine, in York Co., on the Saco R., about 15 miles sw. of Portland. Manufacturing includes textile machinery, wood products, and textiles. Saco is the site of York Institute, which houses collections of colonial costumes, furniture, historical documents, and minerals. Settled about 1630, Saco was incorporated as a town in 1718 and chartered as a city in 1867. Pop. (1960) 10,515; (1970) 11,678.

SACRAMENT, in Christian theology, rite (q.v.) ordained as an outward and visible sign of an inward and spiritual grace (q.v.). Specifically, such a rite instituted directly by Christ (see Jesus Christ) to give grace. The Roman Catholic Church, Orthodox Church (qq.v.), and some other churches regard such rites as having been instituted directly by Christ and deriving from this fact an inherent efficacy. A sacrament, to be entirely efficacious, must be performed in the Church or by one who is recognized as an agent for the Church.

Seven sacraments are recognized by the Orthodox and Roman Catholic churches—Baptism, Confirmation, the Lord's Supper, Penance (qq.v.), Holy Orders (see Orders Holy), Matrimony, and Extreme Unction (q.v., Roman Catholic), or Unction of the Sick (Orthodox). Baptism, Confirmation, and Holy Orders are held to leave a permanent impress, or character, on the soul (q.v.); they are administered only once in an individual's lifetime. Baptism and the Lord's Supper are recognized as Christian ordinances (and to be literally observed) by many Protestant churches (see Protestantism). Sacraments are regarded by various Christian bodies (1) as channels of grace, (2) as the seal of God's promises of grace, or (3) as a sign, pledge, or badge of his Christian profession on the part of the recipient. Some hold one or two of these views to the exclusion of the remainder. The word "sacrament" is sometimes applied to any of various ordinances of the old dispensation—as that of circumcision (q.v.).

SACRAMENTO, city and capital of California, and county seat of Sacramento Co., on the Sacramento R., 75 miles n.e. of San Francisco. Sacramento is the wholesale and retail center of a large agricultural area and is on the main line of two transcontinental railroads. The industrial establishments in the city include canning and food processing factories and one of the world's largest almond shelling plants. Jet pro-

pellants and soaps are among the manufactures. The State capitol, completed in 1874, is a neo-classical building surrounded by a spacious park. The city is the site of California State University at Sacramento (1947) and the E. B. Crocker Art Gallery. Nearby is Mather Air Force Base.

History. In 1839 the Swiss-American pioneer John Augustus Sutter (q.v.) received a land grant from the Mexican government and established a colony known as New Helvetia. In 1844 Fort Sutter was completed at the settlement, which became one of the most important trading posts in California. Gold was discovered on Sutter's land in 1848, and a town, named Sacramento, was built at the site. By 1850, the year that California gained Statehood, the population of the town was nearly 7000. In 1854 Sacramento was chosen to be the permanent seat of State government, and in 1863 it was incorporated as a city. Pop. (1960) 191,667; (1970) 254,413.

SACRAMENTO, principal river of California. The Sacramento rises in the Klamath Mts. near Mt. Shasta and empties into San Francisco Bay. It is almost 400 mi. long; its largest tributary, the Pit R., is about 200 mi. long. Flowing s. for most of its length, the Sacramento turns w. below the city of Sacramento, unites with the northward flowing San Joaquin R., and passes through the Suisun and San Pablo bays into San Francisco Bay. The river is navigable to Red Bluff, about 250 mi. upstream. The Sacramento and its tributaries were the scene of the California Gold Rush of 1849. Together with the San Joaquin, the Sacramento forms the Central Valley of California, one of the richest of agricultural areas.

SACRIFICE, in religion, offering to a deity. It is a fundamental phase of religion in all parts of the world. Primitive tribes regard themselves as related to their gods by kinship, and the tribe has certain sacred animals that it regards as related to the tribal god by the same bond. To slaughter one of these animals for private use is an act of sacrilege. Sacrifice is a solemn public function. The significant part of it is not the slaying of the victim, but the sacrificial meal that follows. During this meal the life of the sacrosanct animal is supposed to pass physically into the communicants. Infinite diversity in detail exists, and what is prescribed among one people is forbidden among another.

The deity in another phase of worship is regarded as an ethereal being. The difficulty of communication with him is overcome mainly by the use of fire, which etherealizes the sacrifice, or burnt offering, and sends it up to the deity in savory vapor. Still another phase takes the form

of gifts to the gods, whether as a means of appeasement, as tribute, or, when the gifts are human or animal sacrifices, such as scapegoats, as a vehicle for the expiation of sin, that is, for atonement (q.v.). Fruits, vegetables, and cereals also have been used as gift offerings.

In Christianity, the sacrificial meal is the Lord's Supper (q.v.). The sacrifices of the Jews ceased with the destruction of the Temple; see *TEMPLE: Temple at Jerusalem*. See also *RELIGION: The Religions*.

SACROILIAC JOINT, fibrous joint in the lower back between the lumbar vertebrae and the coccyx, the bones at the lower end of the spinal column. It is composed of five fused vertebrae that form a solid triangular bone, the sacrum, and the two hip bones. The joint is bound by ligaments so powerful that they may seldom be sprained to cause low back pain. Pain attributed to the sacroiliac area is more generally caused by a displaced vertebral disc; see *SPINAL COLUMN: Abnormality and Disease*.

The sacroiliac joint is subject to a number of diseases embraced by the term spondylitis, an inflammation of the vertebrae, often rheumatic in character and sometimes caused by infection. It is frequently accompanied by ankylosis, a fusion of bones resulting in rigidity of the joint. The disease is chronic and usually progresses upward to involve the higher joints of the spine. Early recognition, diagnosis by X ray, and treatment by deep radiation therapy, administration of cortisone (q.v.) preparations, exercises, and orthopedic procedures (see *ORTHOPEDICS*) are essential to control the disease, which otherwise may progress to involve the entire spine.

See *LUMBAGO; SCIATICA*.

SACRUM. See *SPINAL COLUMN: Anatomy and Physiology*.

SADAT, Anwar el- (1918-), Egyptian leader, president of the Arab Republic of Egypt and the first Arab leader to recognize Israel.

Sadat was born Dec. 25, 1918, in the Nile Delta village of Mit Abu el Kom. The son of a poor hospital clerk, he was chosen for the military academy, where he joined Gamal Abdel Nasser (q.v.) in plotting against the British-dominated Egyptian monarchy. Jailed twice for German collaboration in World War II and later for terrorist attacks, Sadat took part in the coup of 1952, in which Nasser ousted King Faruk. Sadat then held public relations posts and the vice-presidency. After Nasser's death in 1970 Sadat was elected president.

To improve the plight of his overpopulated, underdeveloped, debt-ridden country, Sadat was anxious to reduce the heavy military ex-

SADDUCEES

penses entailed by four wars with Israel. Boldly risking the ire of other Arab states, he went to Jerusalem, where he dramatically offered to recognize Israel's existence, which Arabs had previously ignored. Israeli Premier Menachem Begin refused his terms then, but in 1978, in a conference near Washington, D.C., the two men agreed on a framework for negotiating peace. **SADDUCEES**, Jewish school, or party, that arose in the 1st century B.C., taking its name from Zadok, in the Old Testament (2 Sam. 15:24-29) a priest during the reigns of kings David and Solomon (q.v.), or from the Zadokites (1 Kings 4:2-4), a family of priests. The Sadducees, an aristocratic party, acknowledged only the written Torah (q.v.) as binding, rejecting the scribes' traditional interpretation and development of the Law; see SCRIBE. Their criminal jurisprudence was so rigorous that the day on which their code was abolished by the Sanhedrin (q.v.) was declared a festival. They rejected Pharisaic tradition, which represented an older legal and an older religious standpoint; see PHARISEES. The Sadducees did not believe in a resurrection (q.v.) or in any personal continuity (see IMMORTALITY), and they denied angels (see ANGEL) and spirits. Sadduceeism is denounced by Jesus Christ in the phrase "beware of the leaven [that is, the doctrine] of the Pharisees and of the Sadducees" (Matt. 16:6, 12). The Sadducees disappeared with the fall of the Jewish state in 70 A.D.; see JEWS: *Subject Judea*.

SADE, Comte Donatien Alphonse François de, better known as **MARQUIS DE SADI** (1740-1814), French writer and soldier, notorious for his sexual perversion, born in Paris. He fought in the French army during the Seven Years' War. His immoral practices came to the attention of the authorities, and in 1772 he was tried and sentenced to death for the commission of perverted sexual acts and for poisoning. He escaped to Italy, however. Upon his return to Paris in 1777 he was arrested and imprisoned at Vincennes. After six years at Vincennes he was removed to the Bastille, and in 1789 to the Charenton lunatic asylum. He was released from the asylum in 1790 but arrested again in 1801 for the publication of *Justine* (1791; Eng. trans., 1953). He was moved from prison to prison and in 1803 again incarcerated at Charenton, where he died.

His other writings, all pornographic in nature, include *Histoire de Juliette* (6 vol., 1797, Eng. trans., *The Story of Juliette*, 1958-59) and *Philosophie dans le Boudoir* (1795; Eng. trans., *The Bedroom Philosophers*, 1953).

The term sadism, used by psychiatrists to de-

note that form of neurosis wherein sexual satisfaction is gained by the infliction of pain on others, is derived from his name.

SAFAD or SAFED. See ZEFAT.

SAFED KOH RANGE, or SEFID KUH, mountain range of N.W. Afghanistan. It extends for 100 mi. and is crossed by the Khyber Pass. The highest peak is Mt. Sikaram, which is 15,620 ft. high.

SAFETY, in the broadest sense, condition of being free from injury and risk. In a more restricted sense, safety refers to precautions people take to avoid accidental injury or death. Accidents may happen anywhere at any time: at home, at work, in public places, while traveling, or during play. The possibility of an accident occurring, however, can be reduced substantially through certain preventive measures. These include careful design, manufacture, and attentive use of power-driven machinery, household equipment, and processed foods and medicines; adequate familial, school, business, and public instruction in proper safety procedures; and strict observance and enforcement of safety regulations.

Specific information on home, consumer, and medical safety are contained in separate articles on BOTULISM; BUILDING ACTS; BUILDING CONSTRUCTION; CONSUMER EDUCATION AND CONSUMER PROTECTION; DISEASE; DRUGS; DRUGS, ADDICTION TO; FIREPROOF CONSTRUCTION; FIRST AID; HEALTH; HOUSE; *Housing Today*; INSULATION; LIGHTNING; MEDICINE; *20th Century Medicine*; POISON; PLOMAINS; PURE FOOD AND DRUG ACTS; RESPIRATION, ARTIFICIAL.

Information on vehicular and transportation safety is contained in the articles AIRPORT: *Air Traffic Control*; AIR TRANSPORT: *Passenger and Crew Safety Measures*; and AUTOMOBILE: *New Developments*.

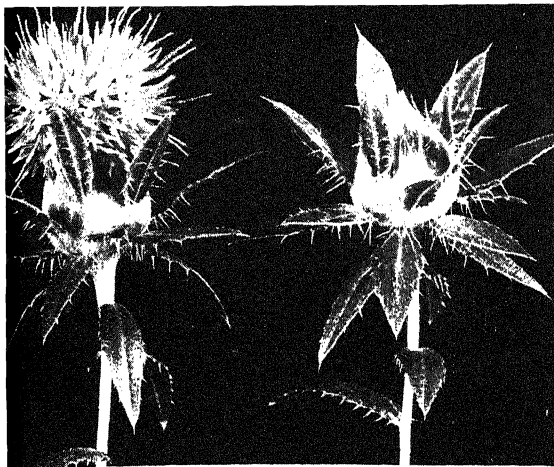
For additional information on safety in industry, see ELECTRIC POWER SYSTEMS; ENGINEERING: *Safety Engineering*; SANITARY ENGINEERING; MINING: *Mine Safety*; RADIATION SICKNESS.

For specific information concerning public, recreational, and environmental safety, see AIR POLLUTION; BOAT: *Modern Boats*; CAMPING; CITY PLANNING; CIVIL DEFENSE; FIRST AID; LIGHTNING; PUBLIC HEALTH; RECREATIONAL VEHICLES; RESPIRATION, ARTIFICIAL; WATER POLLUTION; WEATHER SERVICE, NATIONAL.

See also ACCIDENT; FIRE FIGHTING; INSURANCE.

SAFETY ENGINEERING. See ENGINEERING.

SAFFLOWER, common name applied to an annual herb, *Carthamus tinctorius*, belonging to the Compositae family, Composite. The safflower bears large flowerheads. It is a native of

Safflower, *Carthamus tinctorius*

U.S. Dept. of Agriculture

the Indian subcontinent, widely cultivated in warm countries for a dye, carthamin, obtained from its flowers, and for an oil obtained from its seed.

SAFFRON (Fr. *safran*; Ar. *asfarān*, from *safrā'*, "yellow"), bright-yellow flavoring and coloring material, consisting of the dried stigmas and style branches of the common yellow crocus *Crocus sativus*, the bulbs of which were introduced into Europe from Asia Minor.

SAFI, or **SAFFI**, seaport of Morocco, on the Atlantic Ocean, 140 miles s.w. of Casablanca. It is a center of the fishing industry of Morocco and also exports phosphates. Safi is a compactly built, fortified city dominated by a 16th-century ruined castle of the sultans. The city was held by the Portuguese until 1541. Subsequently it came under French control until Morocco became an independent nation in 1956. Pop. (1971) 129,113.

SAGA. See *ICELAND: History*; *ICELANDIC LITERATURE: The Saga*; *NORWEGIAN LITERATURE: Norwegian-Icelandic Period*.

SAGAMORE HILL NATIONAL HISTORIC SITE, estate formerly belonging to President Theodore Roosevelt (q.v.). The site is located on Cove Neck near Oyster Bay, Nassau Co., N.Y., about 30 miles E.N.E. of New York City. Situated near the summer residence of the Roosevelt family at Oyster Bay, the land at Sagamore Hill was purchased by the future President shortly after he was graduated from Harvard University in 1880. Five years later he had a 22-room house built on the site. In this house, Roosevelt was notified of his nomination as governor of New York State (1898), as Vice-President of the United States (1900), and as President (1904). He maintained the house until his death in 1919. In 1950 the Theodore Roosevelt Association purchased a part of the estate, and in July, 1963, the historic site was established, administered by

the association and the National Park Service (q.v.). The grave of the former President lies about halfway between Sagamore Hill and Oyster Bay village.

SAGAN, Carl (Edward) (1934–), American astronomer and pioneer exobiologist.

Sagan was born in New York City on Nov. 9, 1934. He earned degrees in natural sciences (1954) and physics (1955) at the University of Chicago and, after three years' study of the planets at its Yerkes Observatory, received a PH.D. in astrophysics. Sagan's academic training was directed toward his lifelong pursuit of evidence of life in outer space, and toward that end he also studied the origins of organisms with the geneticists Hermann J. Muller and Joshua Lederberg (qq.v.). Lederberg and Sagan had a large share in establishing exobiology, the search for extraterrestrial life, as a scientific discipline.

After serving as assistant professor of astronomy at Harvard University and astrophysicist at the Smithsonian Astrophysical Observatory (1962–68), Sagan became director of the Laboratory for Planetary Studies at Cornell University. He has worked on many space-exploration projects and has written more than 200 scientific papers concerning the conditions under which extraterrestrial life might be found to exist.

SAGE, common name applied to herbs and shrubs of the genus *Salvia*, belonging to the Mint family, Labiatae. The flowers have a two-lipped calyx and corolla, two functional stamens, and a solitary pistil. Common sage or garden sage, *S. officinalis*, grown in gardens as an aromatic herb for flavoring in cookery, is a native of southern Europe. The leaves and flowering parts of the plant, infused as tea, are considered tonic and astringent. Clary, *S. sclaria*, an aromatic mint grown as a potherb and an ornamental, is a species of sage.

SAGE, Russell (1816–1906), American financier, born in Oneida County, N.Y. After working as a clerk in a grocery store, he conducted a wholesale grocery business in Troy from 1839 to 1857. From 1844 to 1851 he was treasurer of Rensselaer County and from 1845 to 1848 he was an alderman of the city of Troy. He was a Whig representative in the United States Congress from 1853 to 1857. In 1863 Sage moved to New York City where, as an associate of the American financier Jay Gould (see *under* GOULD), he engaged in stock-market transactions and railroad development. He bought a seat on the New York Stock Exchange and became director in several corporations. He left his entire fortune of about \$70,000,000 to his wife, Margaret Olivia Slocum Sage (1828–1918), who devoted a major

SAGEBRUSH

portion of these funds to philanthropy. In 1907 she established the Russell Sage Foundation (q.v.) and in 1916 she founded Russell Sage College at Troy.

SAGEBRUSH, common name applied to several species of aromatic, bitter shrubs in the genus *Artemisia*, native to the plains and mountains of western North America, but especially to the Great Basin, the extensive desert region west of the Rocky Mts. in the United States. It is one of the few woody members of the Compositae family, Compositae. The most common species in the U.S. is *A. tridentata*, a many-branched plant which grows from 1 to 20 ft. in height. It has silvery, toothed leaves and terminal clusters of small, yellow flowers. A similar species, *A. arbuscula*, attains a maximum height of 1 ft., and is abundant in the plains of Colorado and Wyoming. As sagebrush often grows in regions where there are few other woody plants, it is sometimes used for fuel. In some areas the foliage is used as winter forage. Overgrazing of native grasses has caused a proportionate increase in sagebrush. The sagebrush is the State flower of Nevada.

SAGE GROUSE. See GROUSE.

SAGHALIEN. See SAKHALIN.

SAGINAW, city and port of entry in Michigan, and county seat of Saginaw Co., on the Saginaw R., 35 miles N.W. of Flint. A major processing and shipping center, sugar beets and beans are grown. Important manufactures include automobile parts, machinery, graphite products, metals, and chemicals. Originally a fur-trading post on the west bank of the Saginaw R., the settlement grew around Fort Saginaw, built about 1820. A flourishing lumber industry developed in the early 1830's which lasted until the end of the century. The city was chartered in 1857. The city of East Saginaw, founded on the opposite bank of the river in 1849, was incorporated in 1859. In 1889 the two cities were consolidated to form the new city of Saginaw. Pop. (1960) 98,265; (1970) 91,849.

SAGINAW BAY, arm of Lake Huron in Michigan, about 60 mi. long and 15 to 25 mi. wide, extending S.W. from the lake into east-central Michigan. It receives the Saginaw R.

SAGITTARIUS, southern constellation located partly in the Milky Way (q.v.) south of Aquila, and the ninth sign of the zodiac (q.v.). Eight of its stars, the brightest of which is the fourth-magnitude star Rukbat (α Sagittarii), are visible to the naked eye. Sagittarius is represented pictorially as a centaur shooting an arrow.

SAGO, starch prepared from the pith of several genera of palms, *Metroxylon*, *Borassus*, and

Arenga, and from cycads, of the genus *Cycas*, native to the East Indies. It is an important part of the diet and is also exported to Europe and America for thickening soups and making puddings. See CASSAVA.

SAGUARO NATIONAL MONUMENT, cactus forest of S.E. Arizona, in Pima Co., 10 miles E. of Tucson. The forest contains more than twenty-five species of cactus, the most outstanding of which is the saguaro, a giant flowering cactus unique to the deserts of N.W. Mexico and S. Arizona. It is administered by the National Park Service (q.v.).

SAGUENAY, river of S. Québec Province, Canada, about 170 km (106 mi.) long. It rises in Lac Saint-Jean and flows S.E. to the Saint Lawrence R., at Tadoussac. Hydroelectric facilities on the upper river, above Chicoutimi, supply power to pulp and paper mills and to a large aluminum plant at Arvida. The river widens below Chicoutimi, the head of navigation for large ships, and flows fjordlike between precipitous cliffs, which are more than 490 m (1600 ft.) high at capes Eternity and Trinity. The scenic Saguenay valley attracts many tourists in summer.

SAGUNTO (anc. *Saguntum*), city of Spain, in Valencia Province, about 15 miles S. of the city of Valencia. Founded by Greek colonists, the city was an ally of Rome during the Punic Wars (q.v.). Carthage was bound by treaty to respect the city's independence, but in 219-218 B.C., the Carthaginian general Hannibal (q.v.) attacked and captured the city. This incident led directly to the Second Punic War. Saguntum was conquered by the Romans in 214 B.C. and administered as a *municipium*, or Roman municipality, whose citizens spoke Latin. In the early 3rd century the Moors captured the city and called it Murviedro; it was renamed Sagunto in 1827. In the city are Roman ruins of a bridge, a theater, and fortifications. Pop. (1970) 46,782.

SAHARA, great desert area of S. Africa, the W. portion of the broad belt of arid land that extends from the Atlantic Ocean eastward past the Red Sea to Iraq. The entire desert, the largest in the world, is about 1000 mi. wide and about 3200 mi. long from E. to W. The total area of the Sahara is more than 3,500,000 sq. mi., of which 80,000 sq. mi. consist of partially fertile oases.

The boundaries of the Sahara are the Atlantic Ocean on the W., the Atlas Mts. and the Mediterranean Sea on the N., the Red Sea and the Arab Republic of Egypt on the E., and the Sudan and the valley of the Niger R. on the S. The boundaries, however, are not clearly defined.

Three Divisions of the Sahara. Geographically distinct are: the W. Sahara, which is some-



A view of the Sahara in southern Tunisia, with an oasis in the background.

Tunisian National Tourist Office

times called the Sahara proper; the central Ahaggar Mts. and Tibesti Mts., a plateau region; and the Libyan Desert in the E. The W. Sahara is an area of rock-strewn plains and sand deserts of varying elevation. The land is almost entirely without rainfall or surface water but possesses a number of underground rivers that flow from the Atlas and other mountains. Occasionally the waters of these rivers find their way to the surface, and in these naturally irrigated oases plants grow freely. The soil of this region of the Sahara is fertile and, in localities where irrigation is possible, produces excellent crops. The central plateau region of the Sahara runs for approximately 1000 mi. in a N.W. to S.E. direction. The plateau itself varies in height from 1900 to 2500 ft., and peaks in the several mountain ranges that rise from the plateau are from about 6000 to

more than 11,200 ft. high. Notable peaks include Emi Koussi (11,204 ft.), in the Tibesti Mts., and Tahat (9850 ft.), in the Ahaggar range. Although the rainfall is scanty, some of the central Saharan peaks are snow-capped during part of the year.

The Libyan Desert is considered the most arid part of the whole Sahara. Moisture is almost totally absent and few oases exist. The land is characterized by sandy wastes and large dunes of sand 400 ft. or more in height. The valley of the Nile R. and the mountainous area of the Nubian Desert to the E. of the Nile are, geographically, a part of the Sahara, although the irrigation afforded by the Nile transforms the desert into fertile agricultural land throughout much of the Arab Republic of Egypt.

The Sahara as a whole is a tableland with an average elevation from 1300 to 1600 ft. Only comparatively small areas are elevated as little as 500 ft. above sea level. In the Arab Republic of Egypt and Algeria limited areas, such as the Qattâra Depression, are below sea level. The climate is uniformly dry, with no part of the desert receiving more than 10 in. of rain a year. The temperature range is extreme, ranging between freezing to over 130° F in the W. and central portions. Except in the oases the desert is almost devoid of vegetation, although some stunted, thorny shrubs grow in the W. Sahara. Man-made oases have been created by drilling water wells several thousand feet deep. The chief trees of the oases are the date palm and a form of acacia. Gazelles and antelope are found in many parts of the desert, as are jackals, foxes, badgers, and hyenas. The Libyan Desert is virtually devoid of any form of animal or vegetable life.

The N. Sahara has assumed economic importance with the discovery of extensive oil deposits in Algeria and Libya.

Politically, the Sahara lies largely in Morocco, Algeria, Tunisia, Mauritania, Mali, Niger, Chad, and Nigeria. Some parts of the desert extend also into the Arab Republic of Egypt, Libya, and Sudan.

SAHARANPUR, city of the Republic of India, in Uttar Pradesh State, 111 miles N.E. of Delhi. Wood products and furniture are manufactured. Founded about 1340, the city was once a summer resort of the Mogul court. It is the site of the government botanical gardens. Pop. (1971) 225,698.

SAIDA or **SIDON**, city and seaport of Lebanon, on the Mediterranean Sea, about 25 miles S.W. of Beirut. It exports olive oil, oranges, and lemons, and also cultivates silk, tobacco, and figs. In ancient times it was a city of Phoenicia

SAIGON

(q.v.), famous for its wine and purple dyes. In the surrounding area are numerous rock-cut burial places of the ancient Phoenicians, in which have been found the sarcophagi of Eshmunazar, King of Assyria, and others. Pop. (1971 est.) 24,740.

SAIGON, former name of HO CHI MINH CITY, city of Vietnam, on the Saigon R., near the South China Sea. The present city was formed in 1932 by the merger of Saigon with the nearby industrial center of Cholon. It was renamed Ho Chi Minh City in 1976. The city is a commercial and industrial center, an important port, and a rail and road transportation hub. Its manufactures include processed food, beverages, textiles, glass, construction materials, and small ships. It is the site of the University of Ho Chi Minh City and several major research institutes, libraries, and museums.

Saigon probably was founded in the late 17th century by Vietnamese, and Cholon was established in the 1770's by Chinese merchants. The French captured Saigon in 1859, and they formally annexed it and other parts of Cochinchina (q.v.) in 1863. During World War II the city was occupied by Japanese forces. From 1954 to 1976, while Vietnam was partitioned, Saigon was the capital of the Republic of Vietnam (South Vietnam). During the war in Vietnam (see VIETNAM, WAR IN), the city's population was swollen by refugees, and Saigon was at times the scene of heavy fighting. Its capture by insurgents in April, 1975, marked the end of the war. Pop. (1973 est.) 1,825,297.

SAIL, sheet of canvas, nylon, or other material used for the propulsion of wind-driven boats and ships. Sails are bent to the masts, to spars attached to the masts, and to fixed lengths of cordage or wire rope, known as stays, fastened to the masts and to the main body of the vessel.

Sails are generally triangular or rectangular in form but are usually cut to allow a certain amount of fullness or belly to increase their aerodynamic efficiency. Rectangular sails are almost entirely confined to square-rigged ships on which they are hung from yards, which are spars mounted horizontally at various heights on the mast across the axis of the vessel. Fore-and-aft-rigged ships employ triangular sails with the forward edge of the sail attached to the mast and the bottom edge attached to a boom, a spar which is attached at one end near the bottom of the mast, or quadrilateral sails, in which case the upper edge is attached to a boomlike spar called a gaff.

Names of Sails. In square-rigged ships sails are named for the positions that they occupy.

Ahead of the foremast on a typical ship, four small triangular sails are hung from stays between the bowsprit and the foremast. These sails are known, from fore to aft, as flying jib, outer jib, inner jib, and jib, and are fore-and-aft sails. Hung from yards on each of the masts, foremast, mainmast, and mizzenmast are six rectangular or square sails of different sizes. The lowest sails on each mast are called respectively the foresail, mainsail, and mizzensail or crossjack. The two sails above the lowest on each mast are known as the upper topsail and lower topsail, and are identified according to the mast from which they hang, as mizzen-upper topsail. Above the upper topsails are the topgallant sails and above these the royals and the skysails. The lowest sail on each mast, and sometimes the topsail, is also known as a course.

Between the foremast and the mainmast triangular sails are mounted on stays which slant downward from the mainmast to the foremast. These sails are known respectively as the main-topmast staysail, the main-topgallant staysail, and the main-royal staysail. Sometimes staysails are similarly attached to stays between the main and mizzenmasts. A small four-sided fore-and-aft sail mounted on the mizzenmast with a boom at the foot and another spar called a gaff at the head of the sail is known as the spanker.

The naming of sails on fore-and-aft-rigged ships depends upon the masts and the arrangement of the stays. A typical two-masted schooner carries two sails ahead of the foremast, a staysail and a jib. The foremast has a triangular or four-sided foresail, and in the latter case may also have a gaff topsail mounted between the gaff of the foresail and the mast. On the mainmast is the triangular or four-sided mainsail, and the vessel may also have a main staysail between the foremast and mainmast. Schooners and other fore-and-aft-rigged vessels having quadrangular foresails and mainsails are said to be gaff-headed and those having triangular sails in these positions are said to be Marconi-rigged or Bermuda-rigged. Sometimes schooners also carry a square sail on a yard on the foremast and above it another quadrangular sail called a raffe which is secured to the yard at the foot.

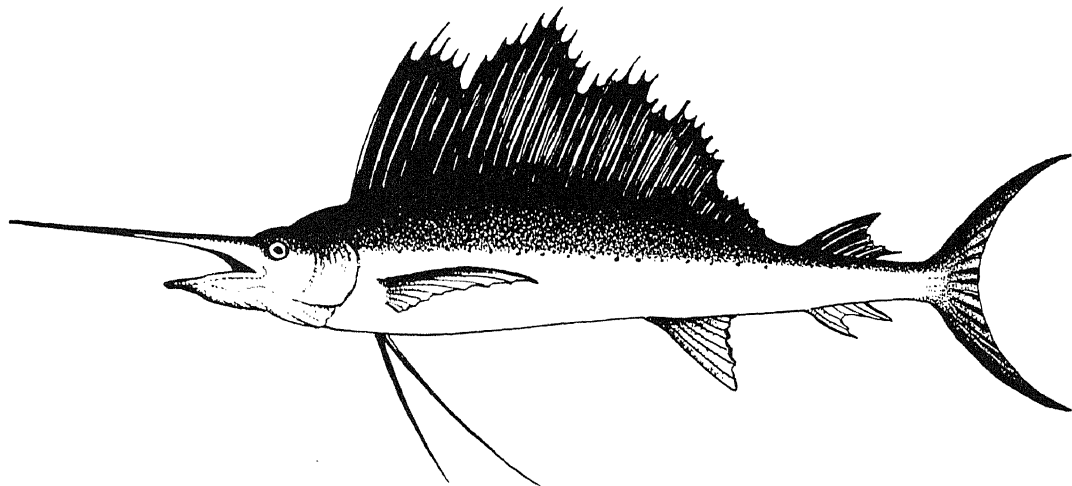
The sail plan of a ketch consists, forward to aft, of staysail, jib, mainsail, and mizzensail, and that of a yawl of staysail, jib, mainsail, and jigger. Cutters and sloops carry staysail, jib, and mainsail only. Certain of the above types of boats sometimes substitute a Genoaese jib for the jib and staysail. This sail is a large jib with a

long foot which overlaps the mainmast or foremast. When running before the wind (see **SAILING**) a spinnaker may be set in place of jib and staysail. This is a triangular sail cut with such great fullness that it is sometimes called a balloon jib or balloonier with its peak hoisted to the top of the foremast and its foot extended over the side of the vessel by means of a demountable spinnaker pole which is secured to the side of the foremast or mainmast.

Parts of Sails. The upper and lower edges of any foursided sail are called the head and foot, and in square sails the vertical edges are called

tion of it is bunched along the yard or boom and secured there by tying the reef points around the bunched-up sail and the spar.

Sails are never made of single pieces of cloth but are always made up of a number of strips of cloth sewed together with flat seams. This structure adds strength to the sail and prevents undue stretching. Sails are reinforced by sewing ropes, called bolt ropes, around all the edges of the sail, and by adding extra thicknesses of canvas at the corners which receive most strain. For attaching rope to the sail, eyes or cringles are spliced in the bolt ropes or cut in the cloth of



Sailfish, Istiophorus americanus

leeches. The lower corners of such a sail are known as clews. In foursided sails used on fore-and-aft-rigged vessels, the head of the sail is laced or otherwise attached to the gaff; the upper corner of the head is called the peak and the lower end (at the mast) the throat. The edge of the sail attached to the mast is the luff. The corner of the sail between the luff and the foot is the tack, and the corner of the sail at the other end of the foot, the clew. The free outer edge of the sail is known as the leech.

The edges of triangular fore-and-aft sails are known respectively as luff, foot, and leech, except in the case of gaff topsails where they are luff, head, and leech. The corners of triangular sails are the peak, tack, and clew. In spinnakers, which are hoisted to the mast by the peak, the sides are the leeches and the foot, and the two bottom corners are the clews.

Most sails are equipped with some means of reefing or reducing the area of the sail during stormy weather. Reefing is usually accomplished by means of a set of small ropes or cords called reef points which are set in a double row on either side of the sail parallel to the yard or boom. To reef, the sail is slackened and a por-

tion of it is bunched along the yard or boom and secured there by tying the reef points around the bunched-up sail and the spar.

See **SAILING**; also **YACHTING**.

SAILFISH, common name applied to pelagic fish of the genus *Istiophorus*, belonging to the family Istiophoridae. The fish has a large, long-rayed dorsal fin. The Pacific sailfish, *I. orientalis*, reaches weights in excess of 200 lb. and lengths exceeding 10 ft. The Atlantic sailfish, *I. albicans*, is somewhat smaller. The sailfish is similar to the swordfish (q.v.), Xiphiidae, but is smaller, and is found in the warmer waters of the Atlantic, especially about the West Indies.

SAILING, propulsion of a boat or ship by means of the driving force of the wind through the use of sails; see **SAIL**.

The Technique of Sailing Boats. Methods vary according to the manner in which the boats are rigged, but the essential principles of sailing are the same for all craft. The simplest and most easily understood point of sailing is called in nautical terms sailing before the wind. On this point of sailing, as the term indicates, the boat follows the same course that the wind

SAILING

is blowing. As shown in diagram A of Fig. 1, the sail or sails are set at approximately a 90° angle to the longitudinal axis of the boat, and derive their power from the push of the wind on their back surfaces. In sailing off the wind, as shown in diagram B the wind reaches the craft from the side, or beam, and the sails are set at approximately 45° from the axis of the craft. In this sailing position, the wind exerts a pulling rather than a pushing action on the sails, which act as airfoils like the wings of an airplane. The general principle of wind action is that the wind flows at a greater rate of speed along the forward surface of the sail, creating an area of lower pressure ahead of the sail. The actual force exerted by the wind is at right angles to the sail, as indicated by the dotted line *a*. This force would tend to drive the boat at an oblique angle if the hull of the boat were perfectly flat. Every sailboat, however, is equipped with a keel lee-board, or centerboard which acts as a flat longitudinal plane to prevent the boat from moving sideways through the water. The effect of this plane is shown graphically by the dotted line *b*, and the actual course of the boat, which is the resultant of the force of the wind and the resis-

ting force of the keel, is the dotted line *c*, representing forward motion.

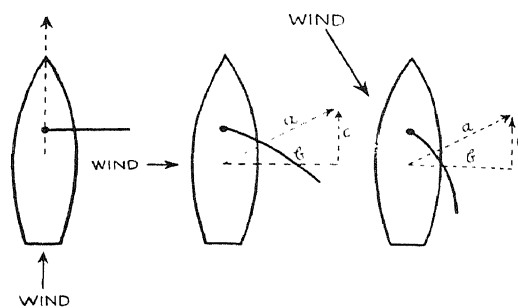


Fig. 1

Tacking. If boats were able to sail only before the wind and off the wind, it would be impossible to reach a destination upwind from the starting point. By sailing on the wind, however, a sailboat can make a course approximately 45° away from the wind direction, as shown in diagram C. By sailing a succession of such courses, first to the left and then to the right of the wind direction, a maneuver called tacking, sailboats can zigzag in an upwind direction, as in Fig. 2. A vessel is said to be on the starboard tack when sailing so that the wind is blowing from the right or starboard side, and to be on the port tack when the wind is blowing from the left or port side.

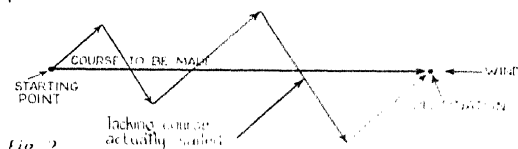


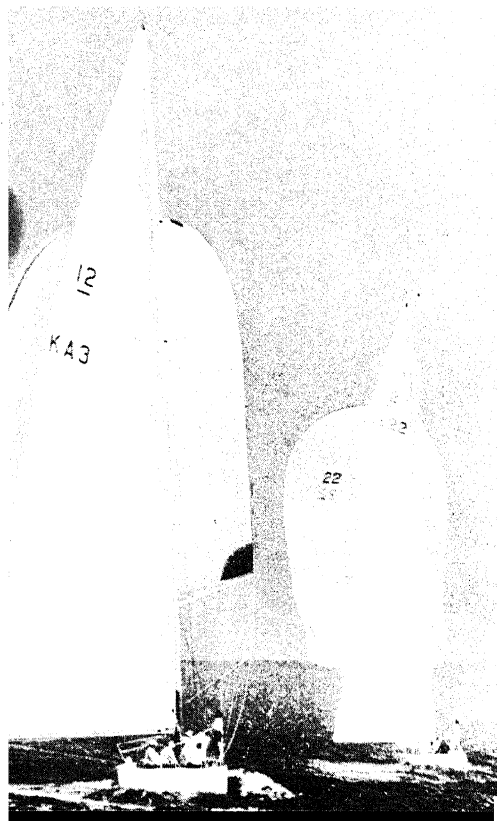
Fig. 2

The procedure of shifting a vessel from one tack to the other may be accomplished in either of two ways. In coming about, the boat is steered so that its bow points up into the wind and then away from the wind on the opposite tack. As the boat points into the wind, it loses speed, the sails being pressed directly backward by the wind. Then as the bow moves away from the wind on the other tack, the sails fill with wind again and assume a position on the other side of the vessel. During the time of coming about, the boat is receiving no motive force from the wind; it must rely on its inertia (q.v.) to maintain enough speed so that it can be steered on to the opposite tack. When the boat does not have sufficient inertia, and stops with its bow pointing into the wind and its sails useless, it is said to be in stays.

The other method of changing tacks consists

In the 1970 America's Cup sailing classic, the U.S. defender and winner Intrepid (22) leads the Australian challenger Gretel II in the third race of the best-of-seven series.

UPI



of steering the boat away from the direction of the wind, until the wind fills the sails from the other side and the boat is on the other tack. In fore-and-aft-rigged vessels, this maneuver is called jibing or gybing, and in square-rigged ships as wearing. When running before the wind, a slight shift of wind may cause a boat to jibe unintentionally. Such jibing is dangerous because of the speed with which the heavy booms at the foot of the sails sweep across the decks of the vessel from one side to the other, and also because of the danger of breaking spars. On wild jibs, control can be lost momentarily and, if the seas are high, a small boat can broach, that is, veer on its side with danger of swamping or capsizing. An unintentional jibe in a heavy wind frequently has enough force to break the masts of a vessel. When jibing intentionally, careful sailors always haul in on the boom while turning, so that they can travel only a short distance when the wind reaches the other side of the sails.

During stormy weather, the area of sail exposed can be reduced by another procedure of sail control known as reefing. Reefing is accomplished by bunching up a portion of the slackened sail along the yard or boom, and then securing the folded canvas with small ropes called reef points. The part of the sail thus taken in is called the reef.

On all sailing ships, sails are hauled up and, to some degree, controlled on the various points of sailing by ropes called sheets and halyards. The most important of these ropes as well as other portions of the fittings and rigging of sailing ships are defined in the article *SAIL*.

See also *NAVIGATION*; *SHIPS AND SHIPBUILDING*.

SAILORS' SNUG HARBOR. See *RICHMOND* (N.Y.): *Parks, Institutions, and Points of Interest*. **SAINFOIN**, perennial, cloverlike herb, *Onobrychis sativa* or *O. viciatetola*, of the legume family, cultivated extensively in Europe for pasturage. It has odd pinnate leaves and elongated spikes of variegated flowers.

SAINT, name applied in the New Testament to the members of the Christian community (see *CHRISTIANITY*) generally, but restricted in ecclesiastical usage from very early times to those who have been virtuous in a heroic degree. The saints of the Roman Catholic Church (q.v.) are distributed into several classes, namely, (1) apostles and evangelists; (2) martyrs; (3) confessors, originally, those who had undergone imprisonment or pains without the final crown of martyrdom and, later, male saints in general who were eminent for sanctity; (4) doctors, saints eminent for sacred learning; (5) virgins;

and (6) matrons and widows: see *APOSTLE*; *EVANGELIST*; *MARTYR*. For the methods by which the title of saint has been conferred in early and in modern times, see *CANONIZATION*. See also separate articles on individual saints.

History. In religious controversy the status of the departed saints and their relation to the church on earth have been much discussed. The Council of Trent (see *TRENT, COUNCIL OF*) affirms that it is a good and useful thing to invoke the saints on account of the benefits to be obtained from God through their intercession. For the veneration paid to images and relics of the saints, see *IMAGE WORSHIP*; *RELICS*.

Of many saints almost all record has perished except their names. The fullest list is found in the general table in the sixty-first volume of the colossal *Acta Sanctorum* of the Bollandists (q.v.), which mentions about 20,000 saints. The catalog that possesses the highest ecclesiastical authority is that of the *Martyrologium Romanum*. The martyrology (q.v.) numbers some 2700 saints, including about twenty saints of the Old Testament, arranged according to the days of their celebration. Many of these saints were honored annually with a special feast (see *FESTIVALS AND FEASTS: Christian Festivals*); in fact, their feast days filled about two thirds of the Catholic Church's liturgical calendar, although some of the saints had become little more than names. In 1964 Vatican Council II (see *VATICAN COUNCILS*) concluded that only saints "of truly universal significance should be extended to the universal Church" and that the others "should be left to be celebrated by a particular church, or nation, or religious community". Accordingly, in 1969, by a *motu proprio* (Lat., "of one's own accord", a document sent forth by the pope without the advice of others), Pope Paul VI (see *under PAUL*) approved a rearrangement of the liturgical calendar to achieve the council's wish. In the revised calendar, which took effect on Jan. 1, 1970, only fifty-eight regular, or obligatory, and ninety-two optional feast days of saints have been retained in addition to those of Christ (see *JESUS CHRIST*), Saint Mary, Saint Joseph (qq.v.), the angels (see *ANGEL*), and the Apostles.

In Christian art (see *CHRISTIAN ART, EARLY*), representations of the saints, as well as of Christ, are often marked by a halo (also known as a nimbus, aureole, or glory), a ring or area of radiance about the head or entire figure, and many of the saints are pictured with emblems by which they could readily be recognized. A martyr who had a special interest in a place was called its patron as early as the 4th century. Trades and professions had their patrons, and

SAINT ALBANS

every disease a saint believed able to cure it. Among the widely known patron saints are Andrew of Scotland, Denis of France, George of England, Nicholas of Russia, Patrick of Ireland, James the Great of Spain, and Stephen of Hungary (qq.v.). The term "hagiology" or "hagiography" is used to denote the branch of literature that is concerned with the lives and legends of the saints.

SAINT ALBANS, Great Britain, municipal borough of Hertfordshire, England, 20 miles N.W. of London. The chief industries are printing, engineering, and the manufacture of clothing. The city was named in honor of the English martyr Saint Alban (q.v.). Offa, King of Mercia (d. 796), in 793 founded a Benedictine abbey, which became the most important and one of the largest in England. From 1871 to 1875 it underwent extensive restoration and in 1877 it was made the cathedral of a new diocese. The city is the site of Saint Alban's School and Saint Michael's Church in which is a memorial to the English philosopher and writer Francis Bacon (q.v.). The English statesman and cardinal Thomas Wolsey (q.v.) was an abbot of St. Albans. The town developed about the abbey, which is on a hill overlooking the Ver R. During the Wars of the Roses it was the scene of two battles; see *ROSES, WARS OF THE*. Pop. (1971) 52,174.

SAINT ANDREWS, Great Britain, burgh of Fife County, Scotland, on Saint Andrews Bay, 15 miles S.E. of Dundee. It has two small harbors and is one of the most fashionable Scottish summer resorts, with fine golf courses stretching along the shore. The Royal and Ancient Golf Club, founded in St. Andrews in 1754, is the world-recognized authority on the rules of golfing. In the town are ruins of the Saint Andrews Cathedral begun in 1160 and destroyed in 1559 and of the castle dating from 1200. The University of St. Andrews, the oldest in Scotland, dates from 1410. The town became an archbishopric in 908 and was the ecclesiastical center of Scotland until the Reformation. Pop. (1971) 11,638.

ST. ANDREWS, UNIVERSITY OF, coeducational institution of higher learning, located in St. Andrews, Scotland. The oldest university in Scotland, St. Andrews was founded in 1410, incorporated in 1412, and granted university status by the antipope, Benedict XIII (see *under* **BENEDICT**), in 1413. Until 1967 St. Andrews comprised St. Mary's College, the United College of St. Salvator and St. Leonard, and Queen's College, Dundee. In that year Queen's College, which had been organized in 1953 by combining University College, Dundee (1881), and the medical

school (1898), was granted a royal charter as the University of Dundee. Of the present colleges, St. Mary's derives from a dwelling obtained in 1419 for the masters of theology and arts known as the Chapel and College of Saint John. It was later absorbed by the pedagogy established in 1430 for the faculty of arts and was reorganized as a college under its present name in 1537. It became a college of reformed theology in 1579. United College was created in 1747 by the merger of the colleges of St. Salvator and St. Leonard, founded in 1450 and 1512, respectively. The university offers instruction in the arts, sciences, medicine, and theology. After a three-year course of study or four years of study for an honors degree, the university awards either the master of arts or the bachelor of science degree. Both degrees are approximately equivalent to an American baccalaureate degree. As graduate degrees the university awards both the degrees of master (distinct from the master of arts) and doctor. The historic 15th-century university chapel is renowned for its architectural beauty. The library contains over 540,000 bound volumes and collections of rare manuscripts and incunabula. In 1967-68 students numbered about 2035 and the faculty, about 260.

SAINTE ANNE DE BEAUPRE, village of Canada, in Québec Province, on the Saint Lawrence R., 21 miles N.E. of the city of Québec. The village is famed as a shrine to Saint Anne, who is honored as the mother of Saint Mary (q.v.). The shrine is visited annually by thousands of Roman Catholic pilgrims. A large church, built in 1876, was destroyed by fire in 1922 but subsequently rebuilt. The church contains religious relics and testimonies to the miraculous powers of St. Anne. Pop. (1971) 1797.

SAINT ANTHONY'S FIRE. See *ERYSIPLES*.

SAINT AUGUSTINE, city and port of entry in Florida, and county seat of Saint Johns Co., on the Matanzas R., 37 miles S.E. of Jacksonville. Among the principal industries are boatbuilding, and the construction of aircraft and mobile homes. The mild, uniform climate of St. Augustine has made it a favorite winter and summer resort. Founded by the Spanish in 1565, St. Augustine is the oldest city in the United States. It is a picturesque city and has some interesting remains, including the ancient fort of San Marco, now in the Castillo de San Marcos National Monument (see *NATIONAL PARK SERVICE*), and the governor's palace. Saint Augustine was burned and sacked by the English buccaneers Sir Francis Drake in 1586 and John Davis (qq.v.) in 1665. In 1763 it passed with the rest of Florida into British hands, but it became Spanish again

in 1783. In 1821 it was transferred to the U.S. During the American Civil War it was captured by Union forces, who held it from 1862 to the end of the war; see CIVIL WAR, THE AMERICAN. Pop. (1960) 14,734; (1970) 12,352.

SAINT BARTHÉLEMY. See FRENCH WEST INDIES; GUADELOUPE.

SAINT BARTHOLOMEW'S DAY, MASSACRE OF, massacre of the Huguenots (q.v.) in Paris, France, on Saint Bartholomew's Day, Aug. 24, 1572. In order to increase the royal power, the queen mother, Catherine de Médicis (q.v.), attempted to play the French Catholic faction led by the house of Guise (q.v.) against the Huguenot faction led by the house of Condé (q.v.). Jealous of the growing power of the Huguenot leader Gaspard de Coligny, adviser to her son Charles IX (qq.v.), King of France, Catherine ordered Coligny's assassination. The plot failed, however, and a number of Huguenot leaders who were gathered in Paris for the wedding of Catherine's daughter to Henry of Navarre, later Henry IV (q.v.), King of France, demanded an investigation. Because an investigation would have implicated his mother, Charles was persuaded by the queen to order the murder of the Huguenot leaders. The number killed cannot be determined with any accuracy; estimates vary from 2000 to 100,000. Coligny was among the first to fall. The massacre spread from Paris to the provinces, causing new religious wars.

SAINT BERNARD, name of two mountain passes in the Alps. **1. GREAT SAINT BERNARD,** on the Swiss-Italian border, E. of Mt. Blanc, about 8110 ft. above sea level. Near the pass stands the hospice or monastery of Saint Bernard, founded in the 10th century by the French monk Saint Bernard of Menthon (q.v.). It is occupied by the Augustinian friars who made it famous by their ministrations to travelers. At the summit of the pass stands the foundation of a small Roman temple of imperial times. In 1964 a highway tunnel, more than 3½ mi. long, under the pass was opened. **2. LITTLE SAINT BERNARD,** SW. of Mt. Blanc, in S.E. France near the Italian border, about 7178 ft. above sea level. It too has a hospice founded by Bernard.

SAINT BERNARD DOG, breed of working dog that originated in Europe sometime before the Christian era, probably from a large Asian dog brought to Europe by Roman soldiers. The most important center for the breeding and employment of the dog has been, since the middle of the 17th century, the hospice of Saint Bernard of Menthon on the Great Saint Bernard Pass in the Alps, E. of Mt. Blanc. The dog was used by the monks of the hospice first as a watchdog

and then to help rescue persons lost in the snowdrifts of the locality. In the past 300 years the dogs, whose power of scent and sense of direction particularly qualify them for detecting persons buried in the snow and for leading rescuers back to the hospice during snowstorms, have saved about 2500 lives. The dog received its present name in 1880. The St. Bernard is a large, powerful animal, weighing from about 150 to about 200 lb.; the male is about 27.5 in. high at the shoulder, the female about 25.5 in. The dog has a massive skull; a short muzzle; medium-sized drooping ears; brown eyes; a strong neck; broad and sloping shoulders; a broad back; and a long, heavy tail that terminates in a blunt tip. Two types of St. Bernard exist, one with a dense, smooth coat of short hair; the other with a coat of moderately long hair. The second type developed after 1830, when the breed was crossed with the Newfoundland dog (q.v.). In color the St. Bernard is red and white.

SAINTE-BEUVE, Charles Augustin (1804-69), French writer and literary critic, born in Boulogne-sur-Mer, and educated in Paris at the Collège Charlemagne and the Collège Bourbon. In 1827 he began a friendship with the French writer Victor Marie Hugo (q.v.), and wrote the first of many articles sympathetic to the works of the Romantic movement in France; see ROMANTICISM. In 1828 he published a group of literary portraits, essays in biographical criticism dealing with French authors of the past, including Nicolas Boileau-Despréaux and Pierre Corneille

Saint Bernard dog

Swiss National Tourist Office



ST. CATHERINES

(qq.v.). A series of lectures he gave on the Jansenist movement (see JANSEN, CORNELIS) of the 17th century was later published under the title *L'Histoire de Port-Royal* ("History of Port-Royal", 1840-59). He was elected to the Académie Française in 1844. In 1849 he began to write a column on current literary topics that appeared first in the Monday editions of the newspaper *Le Constitutionnel* and later in other newspapers; these famous articles were eventually collected as *Causeries du Lundi* (15 vol., 1851-62; Eng. trans., *Monday Chats*, 1877).

The works of Sainte-Beuve revolutionized methods of French literary criticism. He covered every genre of literature in his attempt to replace unqualified admiration and prejudice with exacting scholarship and sensitive discrimination. He was also the author of several volumes of poetry, including *Les Consolations* ("Consolations", 1831), and an autobiographical novel, *Volupté* ("Voluptuousness", 1834).

ST. CATHERINES, city, s. Ontario, Canada, on the Welland Ship Canal. Located on the Niagara Peninsula, a fertile fruit-growing region between lakes Erie and Ontario, the city has large canneries and wineries. Other manufactures include forest products, textiles, motor-vehicle parts, and electrical equipment. It is the site of Brock University (1964) and Ridley College, a noted secondary school. St. Catherines was settled in 1790 and incorporated as a city in 1876. It greatly expanded in area and population in 1961, when several adjacent communities were merged with it. Pop. (1975) 123,351; Census Metropolitan Area 301,921.

SAINT CHARLES, city in Missouri, and county seat of Saint Charles Co., on the Missouri R., about 22 miles n.w. of Saint Louis. Saint Charles is a commercial and manufacturing center for a fertile agricultural area. Industries include the manufacture of dresses, beer, aluminum, and dairy products. Saint Charles is the site of Lindenwood College for Women, a Presbyterian institution established in 1827, and of the Sacred Heart Academy founded in 1818, reputedly the earliest free school west of the Mississippi R. The city was settled in 1769 by the French. With the Louisiana Purchase, the region became a part of the United States, and in 1820 St. Charles was made the first capital of the State, remaining the capital until 1826. The city was chartered in 1849. Pop. (1960) 21,189; (1970) 31,834.

SAINT CHRISTOPHER. See SAINT KITTS.

SAINTE-CLAIRE DEVILLE, Henri Étienne (1818-81), French chemist, born on the island of Saint Thomas, in the West Indies, and educated at the University of Paris. He established the

new faculty of science at the University of Besançon in 1844 and was appointed dean and professor of chemistry there the next year. He became professor of chemistry at the École Normale in Paris in 1851, and became professor at the Sorbonne in 1853. Sainte-Claire Deville began research on resins and turpentine (qq.v.), which led to his discovery of toluene (q.v.), hydrobromide, terpineol, and dinitrobenzene. In 1849 he discovered the compound nitrogen pentoxide (see NITROGEN), and in 1854 devised a method by which aluminum (q.v.) could be produced on a commercial scale. Sainte-Claire Deville also designed high temperature laboratory furnaces, made important investigations of the chemistry of the metallic elements magnesium and platinum (qq.v.), and demonstrated the manner in which chemical compounds separate at high temperatures.

SAINT CLAIR, LAKE, lake astride the border between s.e. Michigan and s. Ontario, Canada. It is 42 km (26 mi.) long and has an area of 1114 sq.km (430 sq.mi.). A heavily trafficked component of the Saint Lawrence Seaway (q.v.), the lake is connected with Lake Huron by the Saint Clair R. and with Lake Erie by the Detroit R. It is a popular summer recreation area.

SAINT CLAIR SHORES, city of Michigan, in Macomb Co., on Lake Saint Clair, 12 miles s.e. of downtown Detroit. Local manufactures include tools and dies, machine and metal products, food products, and industrial equipment. In the city are the Jefferson Beach amusement park and several public beaches. Saint Clair Shores was incorporated as a village in 1925 and as a city in 1950. Pop. (1960) 76,657; (1970) 88,093.

SAINT CLOUD, city in Minnesota, and county seat of Stearns Co., also in Benton and Sherburne counties, on the Mississippi R., 70 miles n.w. of Minneapolis. Saint Cloud is noted for the quarrying and polishing of granite and is a commercial center in a rich farming and dairying area of central Minnesota. Industries include railroad shops, building trades, woodworking, and the manufacturing of iron, brass, paper and paper products, and refrigeration equipment. Saint Cloud is the site of Saint Cloud State College, established in 1866. The city was settled in 1852 and incorporated in 1868. Pop. (1960) 33,815; (1970) 39,691.

SAINT-CLOUD, town of France, in the Hauts-de-Seine Department, on a hill overlooking the Seine R., about 5 miles w. of Paris. Industries include metalworking and ceramics. A palace in St. Cloud, built in 1572, served as the residence of several French rulers, including Emperor Napoleon I (q.v.). It was the scene of Napoleon's

coup d'état and served as the headquarters of General Gebhard Leberecht von Blücher (q.v.) of Prussia in 1815. The palace was destroyed by fire during the German siege of Paris in 1870. Pop. (1968) 28,560.

SAINT CROIX. See VIRGIN ISLANDS OF THE UNITED STATES.

SAINT CROIX ISLAND NATIONAL MONUMENT. See NATIONAL PARK SERVICE.

SAINT-CYR-L'ÉCOLE, town of France, in Yvelines Department, about 3 miles w. of Versailles. From 1808 until 1944 it was the site of the French military academy, Saint-Cyr, established by the French emperor Napoleon I (q.v.) at Fontainebleau in 1802. When the buildings of the academy were destroyed in World War II, the academy was moved to Coëtquidan, and it is now called Saint-Cyr-Coëtquidan. The remains of the academy were preserved as part of a secondary military school that opened at Saint-Cyr-L'École in 1966. Pop. (1968) 17,037.

SAINT DAVID'S, Great Britain, village of Pembrokeshire, Wales, on the Allan Water, about 2½ miles s.e. of Saint David's Head, the most westerly point of Wales, and about 95 miles s.w. of Cardiff. The most important and interesting church in Wales is the 12th-century purple sandstone Norman cathedral in St. David's. According to tradition the modern village was founded in the 6th century A.D. by Saint David (q.v.), the patron saint of Wales, who called his community Mynyw or Menevia. Pop. (1971) 1638.

SAINT DAVIDS ISLAND, one of the Bermuda Islands (q.v.).

SAINT-DENIS, city of France, in Seine-Saint-Denis Department, about 2 miles n. of Paris. Industries include tanning, liquor distilling, metalworking, and the manufacturing of pharmaceuticals, pianos, and glass. The basilica of Saint-Denis contains the tombs of many French kings, also of Catherine de Médicis and Marie Antoinette (qq.v.). It was the site of the abjuration of Protestantism by Henry IV (q.v.), King of France. The basilica was built in the 7th century as an abbey church on the site of the grave of Saint Denis (q.v.), the first bishop of Paris. Pop. (1968) 99,268.

SAINT-DENIS, city, port, and capital of the French overseas department of Réunion, of the island of Réunion, on the Indian Ocean. The city is a commercial center, exporting rum and sugar. Industries include the processing of agricultural products and cigarette manufacturing. Pop. (1972) 85,992.

ST. DENIS, Ruth (1877?-1968), stage name of Ruth Dennis, American dancer, choreographer,

and teacher, born in Newark, N.J. In 1906, after several years as a vaudeville dancer, she appeared in *Radha*, a ballet she had created. She subsequently gave a series of successful dance recitals in both Europe and the United States. In 1914 she was married to the American dancer Ted Shawn (q.v.), with whom she organized the Denishawn School of Dancing and the Denishawn Dance Company. The school produced many outstanding dancers, including the American dancer Martha Graham (q.v.). Miss St. Denis toured the world with her company from 1915 to 1931. She and the American dancer Isadora Duncan (q.v.) are credited with founding modern dance. Her most successful dances were those with an Oriental influence, such as *Nautch*, *Incense*, *Radha*, and *Yogi*. Her autobiography, *An Unfinished Life*, was published in 1939.

SAINT ELIAS, MOUNT, snowcapped peak of the Saint Elias Mts., 5488.6 m (18,008 ft.) high, straddling the border between s.e. Alaska and s.w. Yukon Territory, Canada. It is the fourth highest mountain in North America. The peak was discovered by Vitus Bering (q.v.) in 1741; it was first scaled in 1897.

SAINT ELMO'S FIRE, traditional name for a luminous electric discharge (q.v.) that may be produced from projecting objects during heavy storms. It is usually seen on steeples, the tips of aircraft wings, or the mastheads of ships, and sometimes near the head of a person or the horns of cattle. The phenomenon is so called because Mediterranean sailors considered the discharge a visible token sent by their patron saint, Saint Elmo, who has been identified with Saint Peter González (about 1190-1246), a renowned Spanish member of the Dominicans (q.v.).

SAINT-ÉTIENNE, city in France, and capital of the Loire Department, 30 miles s.w. of Lyon. The city is situated in a major industrial and coal-mining region. Principal industries include the manufacture of alloy steels, automobiles, and textiles. Armaments, now an important modern industry, and the silk ribbons for which Saint-Étienne is famous, have been manufactured in the city since the 16th century. Saint-Étienne has a school of mines and a school of industrial arts and design. Its places of interest include a 14th-century church and museums of fine arts and natural history. Race courses are nearby. Pop. (1968) 216,020.

SAINT-EXUPÉRY, Antoine de (1900-44), French writer and aviator, born in Lyon, and educated at the University of Fribourg. He joined the French air force in 1921, and became a com-

SAINTE-FOY

mercial pilot in 1926. His first two books, *Courrier Sud* (1929; Eng. trans., *Southern Mail*, 1933) and *Vol de Nuit* (1931; Eng. trans., *Night Flight*, 1932), are novels distinguished by a poetic evocation of the romance and discipline of flying. His later works, including *Terre des Hommes* (1939; Eng. trans., *Wind, Sand and Stars*, 1939) and *Pilote de Guerre* (1942; Eng. trans., *Flight to Arras*, 1942), stress the humanist philosophy of Saint-Exupéry. His popular children's book, *Le Petit Prince* (1943; Eng. trans., *The Little Prince*, 1943), is also read by adults, for its allegorical meaning. During World War II Saint-Exupéry rejoined the French air force, was shot down, escaped to the United States, and later joined the Free French forces. On a reconnaissance mission over southern France, his plane was lost and never found. His notebooks, collected under the title *Citadelle* (1948; Eng. trans., *Wisdom of the Sands*, 1950), were published posthumously.

SAINTE-FOY, city of Canada, in Québec Province, on the Saint Lawrence R., 4 miles s.w. of downtown Québec, in the Québec metropolitan area. The Québec Bridge crosses the St. Lawrence R. here. The residential suburban city is the site of the agriculture, commerce, and science colleges of Laval University; a government forestry-research laboratory; and an aquarium and biological center. In 1760 the French, under François Gaston, the Duc de Lévis (1720–87), were victorious over the British in a defensive skirmish here, after the latter had captured Québec city. Pop. (1976) 71,237.

SAINT FRANCIS, river of the United States, a tributary of the Mississippi R. It rises in the Saint Francois Mts. of s.e. Missouri, and flows s., forming for a short distance the boundary between Missouri and Arkansas. The river then continues s. through n.e. Arkansas and empties into the Mississippi about 7 miles n. of Helena. The Saint Francis R. is about 470 mi. long.

SAINT-GAUDENS, **Augustus** (1848–1907), American sculptor, born in Dublin, Ireland. He was brought by his family to New York City, where he attended art courses at Cooper Union and the National Academy of Design. In 1867 he went to Paris to study sculpture at the École des Beaux-Arts, and from 1870 to 1875 he studied antique sculpture in the museums of Rome. In 1875, Saint-Gaudens established a studio in New York City, executing figures and reliefs, principally in bronze. In 1876 he was commissioned to produce his first major public monument, the statue representing the American admiral David Glasgow Farragut (q.v.) that stands in Madison Square, New York City. The work



"The Puritan" (1887), by Augustus Saint-Gaudens, is a landmark of Springfield, Mass. New-York Historical Society

was acclaimed when it was unveiled in 1881.

Subsequently, Saint-Gaudens executed a large number of public and private commissions, notably the portrait figure (1887) of President Abraham Lincoln (q.v.), in Chicago; the Adams Memorial (1891) in Rock Creek Cemetery, Washington, D.C.; and the famous equestrian statue (1903) of the American general William Tecumseh Sherman (see under **SHERMAN**) that stands in Central Park, New York City. Among his other works are a number of bronze portrait medallions and several designs for U.S. coins.

Saint-Gaudens is generally recognized as the foremost American sculptor of his time. His sculptures, in which he often combined delicate low-relief details with life-sized figures, brought a lively realism to the neoclassical style current in the earlier years of the 19th century. In 1965 the United States Congress designated his New Hampshire home the Saint-Gaudens National Historic Site; see **NATIONAL PARK SERVICE**.

SAINT GEORGE'S. See **GRENADA**.

SAINT GEORGE'S CHANNEL. See **IRISH SEA**.

SAINT GEORGE'S ISLAND, one of the Bermuda Islands (q.v.).

SAINT-GERMAIN, TREATY OF, peace treaty between the Allied powers and Austria after World War I (q.v.), signed at Saint-Germain-en-Laye, France, on Sept. 10, 1919. The treaty required Austria, the only remaining part of the former Austro-Hungarian Empire, to recognize the sovereignty of Hungary, to cede territories to Yugoslavia, Czechoslovakia, Poland, Rumania, and Italy, and to accept regulations protecting ethnic minorities within the new Austrian borders. The military clauses allowed Austria a volunteer force of 30,000 men, and the Austro-Hungarian navy was destroyed or distributed among the Allies. Financial reparations for war damages were called for, but money was never paid. Article 88, which forbade any compromise of Austrian independence, was designed to prevent any future union with Germany. This article was responsible for the Austro-German tensions of the 1930's, and it was discarded by the German dictator Adolf Hitler (q.v.), who annexed Austria in 1938. *See AUSTRIA: History; GERMANY: History; HUNGARY: History.*

SAINT GOTTHARD, mountain group in south-central Switzerland, in the Lepontine Alps, in the cantons of Valais, Uri, Ticino, and Graubünden. Saint Gotthard is the source of four important rivers, the Reuss, the Ticino, the Rhône, and the Rhine. The highest point, Pizzo Rotondo, rises to 10,472 ft. Saint Gotthard Road goes through the mountain group and crosses Saint Gotthard Pass, the central pass of the entire Alps, leading from N. Europe to Italy. It was the most used of the Alpine passes from the 14th century to 1882, when the Saint Gotthard Tunnel was completed beneath the pass. A railway runs through the tunnel, which is 9.3 mi. long. Work on a 10½-mi.-long highway tunnel, the longest in the world and costing \$40,000,000, through the Alps in Switzerland, continued in the early 1970's. Work on another tunnel parallel to it was begun in 1971.

SAINT HELENA, island dependency of Great Britain, situated in the Atlantic Ocean at approximately lat. 15°57' S. and long. 5°42' W., about 1200 miles w. of Africa and about 700 miles s.e. of the island of Ascension, the nearest land. The island is of volcanic origin and its surface is rugged and mountainous, reaching an altitude of about 2700 ft. in the High Hills in the s.w. The climate is moderate and healthful and the mean annual temperature is somewhat over 70° F. Potatoes and flax are the chief products. The dependency, which includes the islands of Ascension and Tristan da Cunha (qq.v.), is administered by a governor. The capital and chief port is Jamestown (pop., 1974 est., 1600).

Saint Helena was discovered on May 21, 1502, by a Portuguese navigator, João de Nova; it was then uninhabited. From 1815 to 1821 the island was the place of exile of Napoleon I (q.v.), who died there on May 5, 1821, in the farmhouse of Longwood, near Jamestown. Area of Saint Helena island, 47 sq.mi.; pop. (1973) 5159.

SAINT HELENS, Great Britain, county borough of Lancashire, England, 11 miles N.E. of Liverpool. Located in a densely populated industrial area, it is the chief center in England for the manufacture of glass. Other industries include iron and brass foundries, and important coal mines are located nearby. Pop. (1971) 104,173.

SAINT JAMES'S PALACE, principal London residence of the British sovereigns from 1697 to 1837, now used for court social events. It is located in Pall Mall between Saint James's and Green parks. Originally a hospital dedicated to Saint James, it was reconstructed as a palace in 1532 by the English king Henry VIII (q.v.). Buckingham Palace (q.v.) became the royal residence with the accession of the British queen Victoria (q.v.); the British court is still known as the Court of St. James.

SAINT JOHN. *See VIRGIN ISLANDS OF THE UNITED STATES.*

SAINT JOHN, city of s. New Brunswick, Canada, on the Bay of Fundy at the mouth of the Saint John R. The largest city of New Brunswick, it is an important year-round seaport and a major rail terminus. Its main industries are the manufacture of forest products, processed food, and refined petroleum; fishing; and shipbuilding and ship repairing. Points of interest include the "reversing falls" on the St. John R. (q.v.) and Martello Tower, a harbor fortification built in 1812. The first European to visit the site of Saint John was (1604) Samuel de Champlain (q.v.), who found an Indian village there. In 1631 another Frenchman, Charles de La Tour (1596-1666), established a fortified trading post on the site. In 1758 the British gained control of the area, and in 1783 many Tories from the United States settled there. In 1785 two towns were amalgamated to form Saint John, which thus became the first incorporated city of Canada. A great fire in 1877 destroyed much of the city. Pop. (1976) 85,956.

SAINT JOHN, river of Maine and New Brunswick, Canada, 673 km (418 mi.) long. It rises in Somerset Co., N.W. Maine, and flows N.E. to the New Brunswick line, at Saint Francis. It then forms part of the United States-Canada boundary before entering New Brunswick and flowing s.e., past Fredericton, to the city of Saint John, where it empties into the Bay of Fundy. In New

ST. JOHN

Brunswick the river drives several large hydroelectric plants and drains productive farming regions. The great surge of Fundy at high tide creates a "reversing falls" on the river near Saint John.

ST. JOHN, Henry. See BOLINGBROKE, 1ST VISCOUNT, HENRY SAINT JOHN.

SAINT JOHN OF JERUSALEM, KNIGHTS OF. See KNIGHTS OF SAINT JOHN OF JERUSALEM.

SAINT-JOHN PERSE. See LÉGER, MARIE-RENÉ AUGUSTE ALEXIS SAINT-LÉGER.

SAINT JOHNS, city and capital of Antigua, on an inlet of the Caribbean Sea, 285 miles S.E. of San Juan, Puerto Rico. It exports sugar, rum, and Sea Island cotton and produces handicrafts, fiber products, pottery, and textiles. The city is an old colonial settlement. Points of interest include the Court House (1747), the remains of Fort James (1703), Saint John's Anglican Cathedral (1834), and picturesque houses and alleys. Nearby hotels and beaches have also resulted in the development of a resort. Settled in 1632 by English colonists from Saint Christopher, Saint Johns grew after 1663 when more colonists arrived from England. The island served as a British naval base in the Napoleonic Wars. Coolidge Field, E. of the city, was used by the United States in World War II. The name is also spelled Saint John's. Pop. (1972 est.) 14,000.

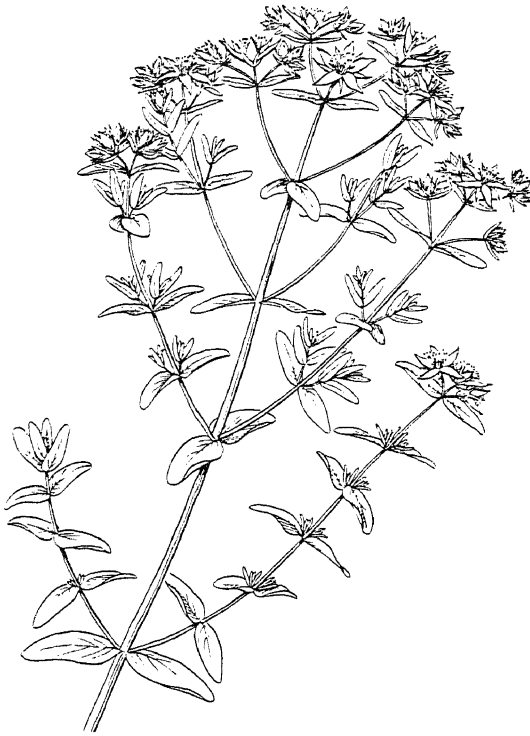
ST. JOHN'S, largest city and capital of Newfoundland Province, Canada, on the Avalon Peninsula of S.E. Newfoundland Island. It is built around an excellent deepwater harbor, which is sheltered by steep hills and is connected with the Atlantic Ocean by a short waterway called The Narrows. The city is an important seaport, a road and rail hub, and a commercial center. Its industries include fishing and fish processing; shipbuilding and ship repairing; and the manufacture of textiles, furniture, and marine engines. Among the city's points of interest are a large Romanesque-style Roman Catholic cathedral (1850); a Gothic-style Anglican cathedral (1850); the Memorial University of Newfoundland (1925); and Signal Hill National Historic Park, which includes the place where Guglielmo Marconi (q.v.) received (1921) the first transatlantic wireless message. The site of the city probably was visited by John Cabot (see *under* CABOT) in 1497, and permanent white settlement there apparently began in 1528. The community was claimed for England in 1583 by Sir Humphrey Gilbert (q.v.), and it served as a major British naval base during the American Revolution and the War of 1812. St. John's was badly damaged by fire in 1846 and 1892. It was incorporated as a city in 1902. Pop. (1976) 86,576.

SAINT JOHNS, river of Florida. It rises in the swamps of Brevard Co., 13 miles S.W. of Melbourne, and flows N. to Jacksonville, forming several lakes along its course. After turning E., the river empties into the Atlantic Ocean. It is 285 mi. long, and is part of the Intracoastal Waterway from Palatka, 85 mi. upstream, to the Atlantic.

SAINT JOHN'S COLLEGE, privately controlled coeducational institution of higher learning, located in Annapolis, Md., with a branch in Santa Fe, N.Mex. The college was founded as King William's School in 1696 and was chartered under its present name in 1784. Its curriculum is based on the study of more than one hundred of the world's greatest books; seminar discussion is supported by tutorials in language, mathematics, and music and by laboratory sciences. The degrees of bachelor and master in the liberal arts are conferred. In 1974 the libraries contained 85,000 volumes. In 1973-74 students numbered 630, the faculty, 93, and the endowment of the college was \$8,660,000.

SAINT JOHN'S UNIVERSITY, coeducational Roman Catholic institution of higher learning, founded as Saint John's College in 1870, and located in Queens and Staten Island, New York City. The institution was chartered as a university in 1906. The Queens campus comprises Saint John's College and several specialized schools, and the Staten Island campus includes Notre Dame College. The university confers the degrees of associate, bachelor, master, doctor, and juris doctor. The university library contains more than 666,986 bound volumes. In 1973 enrollment totaled 13,626 students, the faculty numbered 656, and the endowment of the university was approximately \$11,000,000.

SAINT-JOHN'S-WORT, common name applied to annual and perennial herbs and shrubs of the genus *Hypericum*, belonging to the family Hypericaceae, and native to subtropical and temperate regions throughout the world. Some species of the genus are widely cultivated in garden borders and rock gardens. The plants are characterized by opposite, toothless leaves, generally dotted with blackish spots, which are oil-bearing glands. The flowers are perfect, with five petals and often with numerous stamens. The scrubby Saint-John's-wort, *H. prolificum*, a native of the United States, bears attractive, golden-yellow flower clusters and is a popular garden ornamental. The common Saint-John's-wort, or Klamath weed, *H. perforatum*, is the most abundant of the naturalized species in this genus, having established itself as a weed throughout the U.S. The petals of its flowers are



Saint-John's-wort, Hypericum perforatum

twice as long as the sepals, and are golden yellow, dotted with black along the edges. Once a serious problem for western pasture owners, it has ceased to be important since the introduction of its biological control, a small leaf-eating beetle. The name Aaron's-beard is applied to two well-known, frequently cultivated Saint-John's-worts, the great Saint-John's-wort, *H. ascyron*, an American species which bears huge yellow flowers and grows to a height of 6 ft., and the Jerusalem star or rose of Sharon, *H. calycinum*, a Eurasian species with large yellow flowers.

SAINT JOHN THE DIVINE, CATHEDRAL OF, Protestant Episcopal cathedral of the diocese of New York, in New York City. The structure, begun in 1892 by the American architects Christopher Grant La Farge (1862–1938) and George Lewis Heins (1860–1907), was initially designed in the Byzantine style (see **BYZANTINE ART**). In 1911 the American architect Ralph Adams Cram (q.v.) accepted a commission on the building; he redesigned it as an adaptation of the French Gothic style; see **GOthic ARCHITECTURE**. The nave and west front, except for the towers, were completed between 1924 and 1941. Planned as the largest Gothic cathedral in the world, the church is still unfinished, although regular serv-

ices were inaugurated in 1899. Work was halted as a symbol of the need to divert funds to the needs of the poor, and no date has been set for further construction. Yet to be completed, in a contemporary style, are the transepts, the central tower, and the west towers.

SAINT JOSEPH, city in Michigan, and county seat of Berrien Co., on the Saint Joseph R., opposite Benton Harbor, and about 34 miles N.W. of South Bend, Ind. The city is the trading center for a region rich in fruit. Some of the major manufactures of this industrial city are rubber goods, machinery, and castings. The many beaches and mineral springs attract tourists to this resort city. The site was visited about 1670 by the French missionary Jacques Marquette and about ten years later the French explorer Sieur de La Salle (qq.v.) established a trading post there. A permanent settlement, however, was not founded until the early 1800's. Saint Joseph was incorporated as a village in 1834 and chartered as a city in 1891. Pop. (1960) 11,755; (1970) 11,042.

SAINT JOSEPH, city in Missouri, and county seat of Buchanan Co., on the Missouri R., about 50 miles N. of Kansas City. It is the commercial center of a large area of N.E. Kansas and N.W. Missouri. The principal industries are meat packing and grain milling. A trading post was established on the site of St. Joseph in 1826, and the city was incorporated in 1851. It became the eastern terminus of the Pony Express (q.v.) in 1860, and was a major supply depot for settlers moving westward. Pop. (1960) 79,673; (1970) 72,691.

SAINT-JUST, Louis Antoine Leon de (1767–94), French revolutionary leader, born in Decize, and educated in law at the University of Rheims. In 1789 he published the long poem *Organt*, in which he satirized the French monarchy and aristocracy. He was in Paris in 1789 at the outbreak of the French Revolution (q.v.) and later became a lieutenant colonel of the national guard in Blerancourt, in the department of Aisne. In 1792 he was elected as deputy for Aisne to the National Convention (q.v.). He voted for the execution of Louis XVI (q.v.), King of France, and became a close associate of the French revolutionist Maximilien de Robespierre (q.v.). Saint-Just was active in military affairs during the French Revolution and in 1794 he was elected president of the convention. He supported Robespierre during the Reign of Terror in 1793–94 and took the leading part in the conviction of the revolutionist Georges Danton (q.v.). On July 27, 1794, at the downfall of Robespierre, the convention ordered the arrest of St.-Just, and the following day he was executed.

SAINT KITTS

SAINT KITTS or **SAINT CHRISTOPHER**, one of the Leeward Islands in the West Indies. Saint Kitts is traversed by a mountain range, the highest point being Mt. Misery (4314 ft.). The average annual temperature is 80° F. Sugar and molasses are the chief products, together with some cotton and tobacco. Exports in the early 1970's amounted to more than \$8,000,000 annually, of which sugar was valued at about \$7,500,000. The population of the island (1971, 33,664) consists primarily of descendants of Europeans and of West Africans. English is the official language, but local dialects are also spoken. The area is about 65 sq.mi. Basseterre (pop. 1970 prelim., 13,055) is the chief port and capital.

Saint Kitts is part of the State of St. Kitts-Nevis of the West Indies Associated States, which are in free association with Great Britain. Each state has control over its internal affairs, but foreign affairs and defense remain the responsibility of Great Britain. (Anguilla withdrew from the state in 1971.) The government of St. Kitts-Nevis is headed by a premier, who is assisted by a cabinet, and an elected House of Assembly.

History. Saint Kitts was discovered in 1493 by the Italian-born Spanish explorer Christopher Columbus (q.v.). It was made the site of the first English settlement in the West Indies in 1623. The island was seized by the French several times in the 17th and 18th centuries, but finally ceded to Great Britain by the Treaty of Utrecht in 1713.

See also **LEEWARD ISLANDS**; **WEST INDIES**, **THE**.

SAINT LAURENT, city of Canada, in Québec Province, on Montréal Island, 6 miles N.W. of Montréal. Chief industries of the city include the manufacture of aircraft parts, railway cars, textiles, chemicals, and iron and steel products. Saint Laurent is the site of Basile-Moreau College (1929), College de St.-Laurent (1847), St. Croix Seminary (1899), and the headquarters of the National Film Board of Canada. Saint Laurent was founded in 1845 on the site of a mission dating back to 1720. It was incorporated as a city in 1955. Pop. (1976) 64,404.

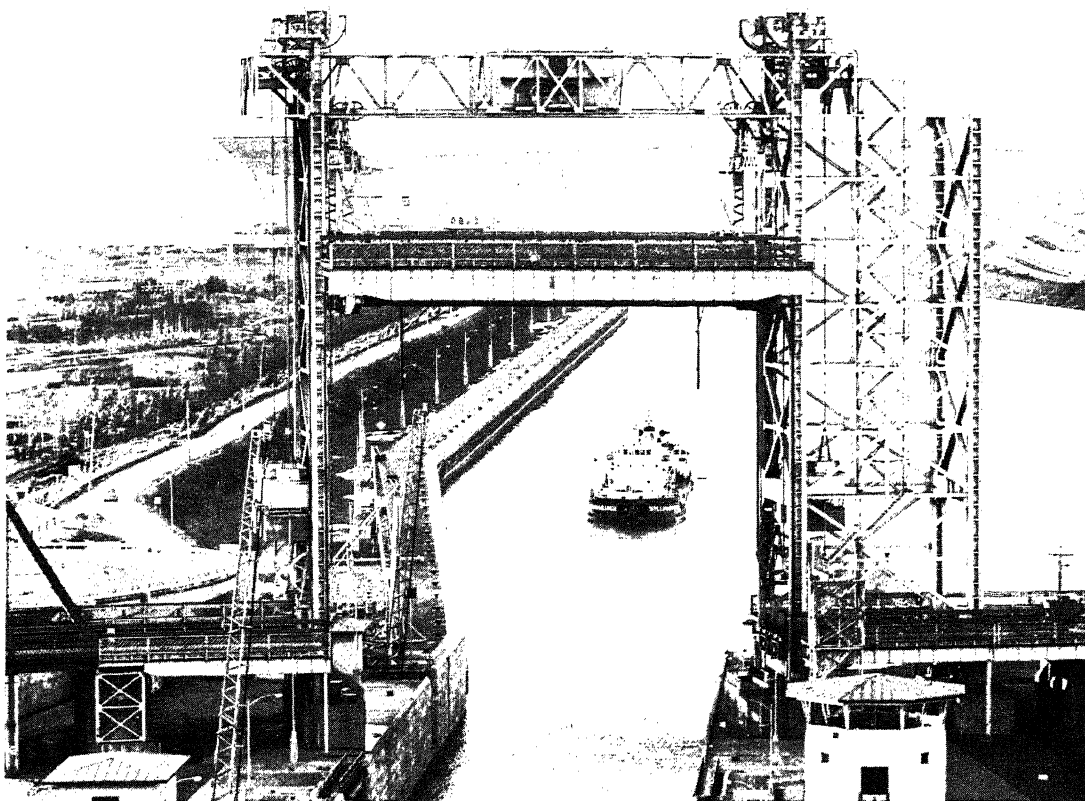
ST. LAURENT, Louis Stephen (1882-1973), Canadian statesman, born in Compton, Québec Province, and educated at Saint Charles College and Laval University. He began to practice law in the city of Québec in 1905, became professor of law at Laval University in 1914, and was president of the Canadian Bar Association from 1930 to 1932. A prominent member of the Liberal Party of Canada, he entered government service in 1941 as minister of justice and attorney general in the Liberal cabinet of Prime Minister William Lyon Mackenzie King (q.v.). In a by-election

of 1942 St. Laurent was elected to the House of Commons from Québec-East; he retained his seat in the house after the general elections of 1945. In the same year he represented Canada at the San Francisco Conference, where he was instrumental in establishing the United Nations (q.v.), and in 1946 he led the Canadian delegation at the first session of the General Assembly. In September, 1946, he was appointed secretary of state for external affairs. St. Laurent became head of the Liberal Party and prime minister in 1948, after King retired. He resigned from these posts in 1957, when the Liberal Party was defeated in general elections. St. Laurent's achievements include the incorporation of Newfoundland as the tenth Canadian province in 1949 and the improvement of relations between the English and French communities of Canada. His policy of encouraging foreign immigration substantially increased the Canadian population.

SAINT LAWRENCE, *Fr. Saint-Laurent*, great river of E. North America, about 1200 km (745 mi.) long, the chief outlet of the Great Lakes (q.v.). The St. Lawrence R. system, which includes the Great Lakes, is 3059 km (1900 mi.) long; its source is the Saint Louis R., in Minnesota.

The St. Lawrence proper rises in N.E. Lake Ontario and flows N.E. to the Gulf of St. Lawrence, at Anticosti Island. In its upper course, which includes the scenic Thousand Islands (q.v.), the river forms the boundary between Ontario, Canada, and New York State. It then widens into Lake St. Francis, which serves for a short distance as the border between Ontario and Québec Province, Canada, before flowing wholly in Québec for the remainder of its course. At Montréal the river expands to create Lake St. Louis, and below Sorel it forms the much larger Lac St-Pierre (Lake St. Peter). Below Québec city the St. Lawrence broadens from a width of about 3.2 km (2 mi.) to one of 145 km (90 mi.) at its mouth, where it discharges great quantities of water. Ocean tides extend up the river for about 800 km (497 mi.), to Trois-Rivières. The main tributaries of the St. Lawrence are the Ottawa, St. Maurice, and Saguenay rivers, from the N., and the Richelieu, St-François (St. Francis), and Chaudière rivers, from the S.

The St. Lawrence is navigable by large ocean-going vessels as far upstream as Montréal, and somewhat smaller ships can continue to Lake Ontario via the Saint Lawrence Seaway (q.v.). Ice accumulations prevent navigation on the upper river from December to April. The St. Lawrence valley's farms produce dairy goods, fruit, potatoes, and grain.



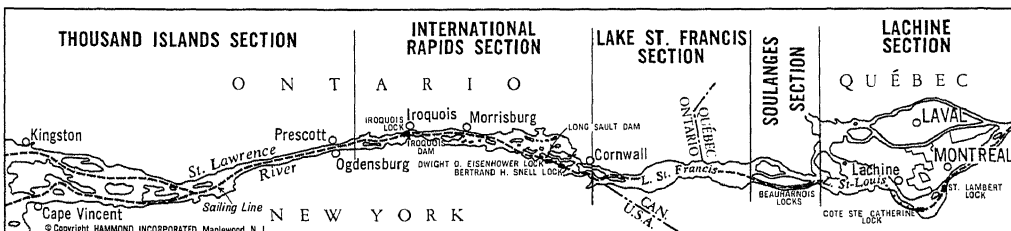
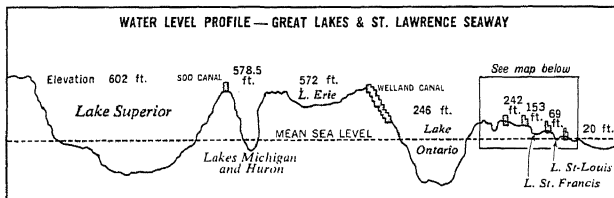
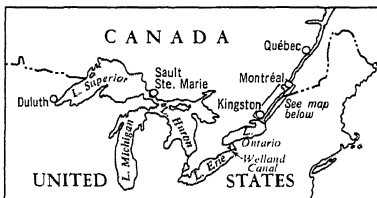
A small inland tanker entering the Saint Lambert Lock, the eastern entrance to the Saint Lawrence Seaway.

Saint Lawrence Seaway Authority

The first European to visit the St. Lawrence R. was the French explorer Jacques Cartier (q.v.), in 1535. The first permanent white settlement on its banks was established (1608) at present-day Québec city by Samuel de Champlain (q.v.).

SAINT LAWRENCE, GULF OF, large arm of the Atlantic Ocean, in E. Canada. It receives the St. Lawrence R. and is connected with the Atlantic by the Strait of Belle Isle, Cabot Strait, and the Strait of Canso. Islands in the gulf include Anticosti Island, Prince Edward Island (a Canadian province), and the Magdalen Islands. Its deep waters contain good fishing grounds.

SAINT LAWRENCE SEAWAY, major development of the St. Lawrence R., S.E. Canada and N.E. United States, permitting oceangoing vessels to navigate between Montréal and Lake Ontario. The seaway is sometimes taken to include the Welland Ship Canal (q.v.), linking lakes Ontario and Erie, and the Sault Sainte Marie Canals (q.v.), between lakes Huron and Superior. The name St. Lawrence Seaway is also used to denote the entire Great Lakes-St. Lawrence R. wa-



SAINT LAWRENCE SEAWAY

terway, which in effect forms a fourth coastline for Canada and the U.S. This article is limited to a discussion of shipping facilities on the upper St. Lawrence, plus a description of the adjacent St. Lawrence Power Project.

The Seaway. From Montréal to Lake Ontario, a distance of 294 km (183 mi.), the Saint Lawrence (q.v.) rises in altitude by a total of 68 m (224 ft.) and has several regions of rapids. In the 19th century Canada constructed canals and locks to allow commercial vessels to navigate this part of the river, and by 1900 all of the component waterways had a minimum depth of 4.3 m (14 ft.). In 1954 Canada and the U.S. agreed to build a system capable of handling more traffic and larger ships. Construction of the St. Lawrence Seaway began that year, and it was opened in 1959. The seaway provides a continuous channel at least 8.2 m (27 ft.) deep and has seven locks. Tolls are charged for using the waterway, which is closed by ice from December to April. It is operated by the St. Lawrence Seaway Authority (Canada) and the St. Lawrence Seaway Development Corporation (U.S.).

The seaway is divided into five sections; see map, above. The Lachine section connects Montréal and w. Lake St. Louis (a widened part of the river). It includes a 29 km (18 mi.) canal bypassing the Lachine Rapids; the canal has two locks, named St. Lambert and Côte Ste. Catherine, which raise ships by a total of 13.6 m (45 ft.). The Soulanges section is made up of the 26 km (16 mi.) Beauharnois Canal, between w. Lake St. Louis and e. Lake St. Francis (another broadened part of the river). The canal also has two locks, which together raise ships by 25 m (82 ft.). The 47 km (29 mi.) Lake St. Francis section, from the e. part of the lake to Cornwall Island, rises by only 0.3 m (1 ft.); the section has a dredged channel but no locks. The 80 km (50 mi.) International Rapids section includes the Wiley-Dondero Ship Channel, with the Bertrand H. Snell and Dwight D. Eisenhower locks (total lift, 27.3 m/90 ft.), and the Iroquois Lock (lift, 1.8 m/6 ft.). The 109 km (68 mi.) Thousand Islands section, the fifth part of the seaway, has dredged channels and no locks. The first three sections are wholly in Canada (Québec and Ontario provinces), and the last two contain segments (notably the Wiley-Dondero Ship Channel) in N. New York.

The seaway handles large quantities of cargo. In the late 1970's, 35,014,000 metric tons of freight moved upstream and 28,321,000 metric tons moved downstream annually. Upstream shipments consisted mainly of iron ore from Québec Province and Labrador to ports on the

Great Lakes; downstream cargo was made up principally of wheat, maize, barley, and soybeans.

The Power Project. The St. Lawrence R., with its great volume of flow and steep descent, is well suited to the production of hydroelectricity. During 1954-60, roughly concurrent with the construction of the seaway, the large St. Lawrence Power Project was built at the International Rapids section of the river. The project includes the Iroquois Dam (at Iroquois, Ontario) and the Long Sault Dam (near Massena, N.Y.), both used to control the river's flow, and the Robert Moses-Robert H. Saunders Power Dam (generating capacity, 1,600,000 kw). The power dam was built between Barnhart Island, N.Y., and Cornwall, Ontario; its generating capacity is shared equally by the U.S. and Canada.

ST. LEGER, Barry. See AMERICAN REVOLUTION: *The Campaign of 1777-78*; ORISKANY, BATTLE OF. **SAINTES, LES.** See GUADELOUPE.

SAINT-LÔ, city in France, and capital of Manche Department, on the Vire R., 47 miles s.e. of Cherbourg. It is an administrative center and a market town. The principal industry is the processing of local agricultural products, including cider, brandy, and cheese. Known before the 6th century as Briovera, it was named after St. Lô, or Laudus, bishop of Coutances (d. 568). In the late 16th century it was a Calvinist center. During World War II (q.v.) the town was almost completely destroyed. After the war it was rebuilt, and medieval ramparts and the Gothic Cathedral of Notre-Dame, begun in the 14th century, were partly restored. Pop. (1968) 19,613.

SAINT LOUIS, principal city of Missouri and of the Mississippi Valley, one of the largest cities in population of the United States, on the w. bank of the Mississippi R., about 5 mi. from its confluence with the Missouri R., and about 200 mi. above the confluence of the Mississippi with the Ohio R. On the e. bank of the Mississippi, opposite St. Louis, is the city of East Saint Louis, Ill. The city covers an area of 61.37 sq.mi. and is divided into sections by a series of shallow valleys. It extends along the riverfront for about 19 mi., spreading westward from the river for about 7 mi., and rising from an altitude of 385 ft. above sea level to 614 ft. The levee extends for about 4 mi. along the central part of the riverfront, and the older industrial area is concentrated here. The newer industrial districts spread out from this section, extending along the railroads and other commercial arteries to outlying regions. Because of the vast industrial expansion of the city, many of the residential districts now lie in adjacent communi-



The Old Courthouse of Saint Louis is framed by the Gateway Arch.
U.S. Dept. of the Interior

ties forming the St. Louis metropolitan area. One of the most important centers of transportation in the U.S. and the second-largest railroad terminal in the country, St. Louis is served by numerous major and minor railroad lines, by major airlines, by bus and truck lines, and by barges and other craft on the Mississippi R. Several bridges span the river at St. Louis.

Among the educational institutions in St. Louis and vicinity are Washington University, St. Louis University (q.v.), the City College of Law and Finance, Harris Teachers College (1857), St. Louis College of Pharmacy (1864), Concordia Theological Seminary (Evangelical Lutheran; 1839), Eden Theological Seminary (German Evangelical Synod of North America; 1850), Kenrick Theological Seminary (Roman Catholic; 1894), the St. Louis Institute of Music, and a new three-campus Junior College District. Cultural facilities include the St. Louis Public Library, the Mercantile Library, the Artists' Guild, the St. Louis Symphony Orchestra, the Civic Grand Opera Association, and the municipal opera. On the river is the Jefferson National Expansion Memorial National Historic Site (q.v.), dominated by the Gateway Arch, designed by the Finnish architect Eero Saarinen (see under SAARINEN). The arch, which soars to a height of 630 ft., is the outstanding architectural structure in St. Louis and the tallest monument in the U.S. In Forest Park, the Jefferson Memorial, of white marble in semiclassical design, houses the collection of the Missouri Historical Society and the trophies and medals of the American aviator Charles A. Lindbergh (q.v.); and the St. Louis Art Museum, one of the outstanding art galleries of the U.S. Forest Park, covering an area of about 1400 acres, also contains the zoological gardens and the municipal open-air theater. Numerous

smaller parks provide additional recreational facilities, and the Missouri Botanical Gardens (125 acres) are noted for a wide variety of plant life.

Notable buildings in St. Louis are the public buildings flanking the Memorial Plaza, including the Civil Courts Building, tallest (375 ft.) building in the city, the U.S. Customs and Courts Building, the City Hall, the Soldiers Memorial, and the Municipal Auditorium, containing an opera house and an arena with seating capacities of 3500 and 12,500, respectively. Facing Union Station on the plaza is the fountain "The Meeting of the Waters", designed by the Swedish-American sculptor Carl Milles (q.v.). Also in this section of the city are the old Roman Catholic cathedral, the Old Courthouse (1862), scene of the Dred Scott trial (see DRED SCOTT CASE); and Busch Memorial Stadium, home of the major-league St. Louis Cardinals baseball and football teams. St. Louis is governed under the mayoral system.

Commerce and Industry. The prominence of St. Louis as a commercial, distributing, manufacturing, and financial center may be attributed to its central position, from which it derives access to abundant raw materials, sources of fuel supply, hydroelectric power, excellent transportation facilities, and a large labor force. The building of many industrial parks in recent years has helped to encourage industries to stay within central St. Louis. The city is one of the world's leading markets for wool, lumber, hides, horses and mules, grain, drugs, dry goods, and hats. It is a leading manufacturer of transportation equipment, second only to Detroit, Mich., in automobile assembly, and a major producer of jet aircraft and of components for the U.S. space

SAINT LOUIS

program. Other chief industries are food products, chemicals, drugs, clothing, primary metals, paper and paper products, toys, electrical machinery, printing, and beer brewing. The extensive wholesale and jobbing houses in St. Louis serve fourteen Midwestern States, and the city also has a vast retail trade. The city is the headquarters for the Federal Reserve Bank of the Eighth District and the site of a Federal Land Bank and other Federal agencies.

History. St. Louis was founded in 1764 as a fur-trading station by René Auguste Chouteau (see *under* CHOUTEAU), representing the interests of Pierre Laclede (1724–78), a French merchant in New Orleans. It was named in honor of the 13th-century Saint Louis, or Louis IX (q.v.), King of France. The settlement came into Spanish possession in 1763 and, as the capital of Upper Louisiana, under actual Spanish authority in 1770. On March 9, 1804, Upper Louisiana was formally transferred to the U.S., in accordance with the terms of the Louisiana Purchase (q.v.), concluded the year before. Under the Americans, St. Louis became successively the seat of government of the District of Louisiana in 1804, of the Territory of Louisiana in 1805, and of the Territory of Missouri in 1812. It was incorporated as a village in 1808, and in the same year the first newspaper west of the Mississippi R., the *Louisiana Gazette*, was founded at St. Louis. The city of St. Louis was chartered in 1822. Until almost the middle of the 19th century the fur trade remained the principal industry of the city, with many great fur companies competing for dominance, including the American Fur Company of John Jacob Astor (see *under* ASTOR).

In the 19th century, with the enormous increase of river traffic and later of railroad transportation, St. Louis developed in commercial and industrial importance. Many European immigrants, notably from Germany and Ireland, settled in the city. During the Civil War, St. Louis was a center of Union sympathy. After the war the city continued to progress in all fields of development. It became the center of a philosophic and cultural school known as the St. Louis Movement. Based primarily upon the teachings of the German philosopher Georg Wilhelm Hegel (q.v.), the movement had an important influence on the cultural development of the Midwest. In 1904 St. Louis was the site of the Louisiana Purchase Exposition (see EXHIBITIONS AND EXPOSITIONS), from which the Jefferson Memorial and the St. Louis Art Museum remain.

Population. Between 1910 and 1950 the population of St. Louis increased from 687,029 to

856,796. In 1960 the population was 750,026; in 1970 it was 622,236.

SAINT LOUIS PARK, city of Minnesota, in Hennepin Co., on Minnehaha Creek, adjoining Minneapolis on the s.w., 5 mi. from the city center. Local manufactures include glass and plastic products, dental supplies, food products, and tools. The county Historical Society Museum is in the city. Settled in 1853, it was incorporated as a city in 1955. Pop. (1960) 43,310; (1970) 48,883.

SAINT LOUIS UNIVERSITY, coeducational Roman Catholic institution of higher learning, situated in Saint Louis, Mo., founded in 1818 by the Society of Jesus (see JESUITS). The university is under the control of a board of trustees of thirty-two members, eleven of whom are Jesuits. The university comprises the colleges of arts and sciences and aeronautical technology; the schools of commerce and finance, dentistry, divinity, engineering and earth science, law, medicine, nursing and health services, and social service; and a graduate school. The university confers baccalaureate degrees in arts and sciences, business, engineering, medical record science, medical technology, nursing, physical therapy, radiologic technology, aerospace engineering, administration, and meteorology. The degree of master is conferred in arts and sciences, business, dentistry, education, engineering, nursing, social work, and theology. Doctoral degrees are conferred in the arts and sciences, business, dentistry, education, health organization research, law, medicine, and theology. The university also confers licentiates in philosophy and sacred theology. The courses of the Parks College of Aeronautical Technology, a branch of the university, are given at Parks Airport, East St. Louis, Ill. University admission is open to persons of all religious faiths; generally, about one third of the student body is non-Catholic. In 1968 the university library housed some 773,000 bound volumes. In 1968 enrollment totaled 11,333 students, the faculty totaled 1668, and the endowment of the university was about \$21,000,000.

SAINT LUCIA, British-associated State of the West Indies, occupying one of the Windward Islands, between Martinique and Saint Vincent. Of volcanic origin, the island is crossed, n. to s., by a wooded mountain range and features many streams and fertile valleys. Bananas, cocoa beans and coconut derivatives are the leading products. Castries, the capital and chief port (pop., 40,000), has one of the best harbors in the West Indies. The climate is mild, despite heavy rainfall.



The Byzantine interior of Saint Mark's Cathedral in Venice, Italy.
Alinari

Saint Lucia is believed to have been discovered about 1500. The first successful colony was founded in 1635 by the French, who signed a treaty with the native Carib (q.v.) in 1660. England held the island between 1663 and 1667. The island changed hands between England and France several times before Great Britain took final possession in 1815. On March 1, 1967, Saint Lucia was granted self-rule in association with Great Britain, which continues to govern its defense and foreign affairs. Area, 238 sq.mi.; pop. (1970) 101,064.

SAINT-MALO, city and port of France, in Ille-et-Vilaine Department, on the English Channel, at the mouth of the Rance R., 40 miles N.W. of Rennes. It is an active seaport, with passenger and freight service to Great Britain, and is part of a popular resort area. The principal industries are shipbuilding, lacemaking, and cordage and chain manufacturing. The town is on a rocky promontory. It was founded in the 6th century and is encircled by ramparts dating from the 12th century. Saint-Malo was severely damaged during World War II, but has been partially rebuilt. Pop. (1968) 43,722.

SAINT MARK'S CATHEDRAL (It. *San Marco*), Roman Catholic cathedral in Venice, Italy, originally the chapel attached to the Doge's Palace, residence and seat of government of the Venetian rulers, and since 1807 the cathedral of Venice. It is named for the patron saint of Venice,

the evangelist Saint Mark (q.v.), whose reputed remains were transported from Alexandria, Egypt, to Venice early in the 9th century. The present structure occupies the site of a 9th-century wooden church, built to hold the relics of the saint, and was constructed in large part between 1047 and 1094. The doge Domenico Contarini (r. 1043–71) employed both Byzantine and Lombard architects, and the result was a unique blending of styles; see **BYZANTINE ART**; **ROMANESQUE ART AND ARCHITECTURE**. The plan of the building, derived from the Church of the Holy Apostles in Constantinople (now İstanbul, Turkey), is a Greek cross of equal arms, covered by a large central dome and by a dome over each of the arms. Important alterations were made beginning in the 12th century, including the addition of the present vaulted narthex, or vestibule, and the elaboration and addition of mosaic and marble decorations on the interior and exterior. In the 13th century copper domes overlaid with gold were placed over the original cupolas, and in the 15th century ornaments in the Gothic style were added to the exterior (see **GOTHIC ARCHITECTURE**). Saint Mark's was adorned with spoils from numerous other buildings, both in the East and in Italy. These spoils include the four bronze horses from Constantinople that were added in 1204. The Pala d'oro,

SAINT MARTIN

or retable of the altar, is one of the finest examples of the art of goldsmiths and jewelers.

SAINT MARTIN, island of the West Indies, one of the Leeward Islands, between the islands of Anguilla and Saint-Barthélemy. The northern portion, called Saint-Martin, is a dependency of the French overseas department of Guadeloupe; the southern portion, called Sint Maarten, is internally self-governed, and associated with the Netherlands. Agriculture and industry are limited, but the tropical, breezy climate and natural beauty of Saint Martin attract many tourists. The French capital, Marigot, and the Dutch capital, Philipsburg, are both free ports. The Dutch and the French simultaneously occupied the island in 1648 and on March 23 of that year they agreed to divide it. Area of the French possession, 21 sq.mi.; area of the Dutch section, 16 sq.mi. Pop. of the entire island (1971) 7778.

SAINT-MAUR-DES-FOSSÉS, city of France, in Val-de-Marne Department, on a bend of the Marne R. adjoining Paris on the s.e., and 8 mi. from the city center. Lying s.e. of the Bois de Vincennes, a part of Paris, it is connected with the capital by road and rail. Manufactures include furniture, leather goods, electrical equipment, apparel, and perfume. A treaty was signed there in 1465 between Louis XI (q.v.), King of France, and the rebellious nobles of Burgundy (q.v.). Pop. (1968) 77,569.

SAINT-MAURICE, river of s. Québec Province, Canada, 563 km (350 mi.) long. It rises in Réservoir Gouin, in the Laurentian Mts. and flows s.e. to the Saint Lawrence R., at Trois-Rivières. The river has several hydroelectric plants, and is also used to float logs to processing plants. Its chief tributary is the Matawin R.

SAINT-MIHIEL, BATTLE OF, first engagement of World War I (q.v.) in which United States forces fought independently. The battle occurred in the town of St.-Mihiel (pop. in 1968, 5382), in Meuse Department, France, 20 miles s.e. of Verdun. After victory at Château-Thierry (see MARNE, BATTLE OF THE), on July 18, 1918, U.S. troops under General John Joseph Pershing (q.v.) prepared to attack the St.-Mihiel salient, a position held by the Germans since September, 1914.

The attack opened on Sept. 12, 1918, during the evacuation of the area by the Germans. The U.S. troops captured Saint-Mihiel and cut off the retreating Germans on the first day of battle. Two American regiments took more than 16,000 prisoners, suffering themselves fewer than 7500 casualties during the operations.

SAINT MORITZ, town of Switzerland, in Graubünden Canton, on the Inn R. and the Lake

of St. Moritz, in the Upper Engadine, about 85 miles s.e. of Zürich. Surrounded by high peaks, St. Moritz is a winter and summer resort. It has become one of the leading winter sports centers of the world. The Winter Olympics (q.v.) were held here in 1924 and 1948. The town was known for its mineral springs in the 15th century; the nearby St. Moritz-Bad is a noted spa. Pop. (1970) 5699.

SAINT-NAZAIRE, city and port of France, in Loire-Atlantique Department, at the mouth of the Loire R., about 40 miles n.w. of Nantes. It is one of the chief Atlantic seaports of France, and is a major shipbuilding center. Active trade is carried on from the port with nations in Europe, Africa, and the Americas. Minerals, agricultural products, and textiles are exported; wood, coal, and metal are the chief imports. During World War II (q.v.), on March 28, 1942, a British commando raid destroyed the German-held docks and submarine facilities; by the following year the town had been virtually destroyed by Allied bombings. Pop. (1968) 63,289.

SAINT-OUEN, city and port of n. France, in Seine-Saint-Denis Department, on the Seine R. just n. of Paris. It is a commercial and industrial center and has extensive port facilities. Manufactures of the city include motor-vehicle parts, electrical equipment, machine tools, and processed food. At Saint-Ouen on May 2, 1814, Louis XVIII (q.v.) declared himself the constitutional monarch of France. Pop. (1968) 48,886.

SAINT PATRICK'S CATHEDRAL, Roman Catholic cathedral of the archdiocese of New York, in midtown New York City. It is one of the outstanding examples of the Gothic revival style of architecture (see REVIVAL). The white marble edifice, designed by the American architect James Renwick (q.v.), was begun in 1858 and dedicated in 1879. The building design is predominantly derived from the French Gothic style of the 13th century; see GOTHIC ARCHITECTURE. The plan is in the shape of a Latin cross more than 300 ft. long. The cathedral has three aisles, side chapels, and an ambulatory around the apse leading to other chapels. The notable features of the cathedral include the decorated bronze doors at the main entrance, the stained-glass windows, and the massive bronze altar. The twin spires are 330 ft. high.

A Protestant cathedral in Dublin, Ireland, and several other Roman Catholic cathedrals in the United States bear the name of St. Patrick's.

SAINT PAUL, capital and second-largest city in population (1970) of Minnesota, and county seat of Ramsey Co., on both sides of the Mississippi R., adjacent to Minneapolis on the w., with

The Gothic facade of Saint Patrick's Cathedral, in New York City. UPI



which it forms the Twin Cities. The capital is at the foot of the rapids, 7 mi. below Saint Anthony's Falls; it rises over a series of terraces from an elevation of 687 ft. at the banks of the river to 1060 ft. in the N.E. part of the city. The city covers an area of 55.44 sq.mi. The railroad yards and industrial establishments are on the lower level, the retail district on higher ground, and the residential section in the still more elevated area. A major transportation center, St. Paul is served by airlines operating out of the Minneapolis-St. Paul International Airport, buslines, major railroads, barge lines on the Mississippi, and many motor-freight carriers. The 2200-acre park system includes Como Park (450 acres), with a zoo and a conservatory. The city is the site of the St. Paul Winter Carnival, held annually since 1886, and the Minnesota State Fair. Metropolitan Stadium, with a seating capacity of 49,000, is the home of the professional Minnesota Vikings of the National Football Conference and the Minnesota Twins baseball team of the American League. Notable buildings in St. Paul include the State Capitol, designed by the American architect Cass Gilbert (q.v.), and the modern City Hall and Court House, before which stands the 44-ft. onyx statue the Indian God of Peace. Under construction in the early 1970's was Capi-

tal Centre, a \$200,000,000 project for renewal of the central business district, including municipal, industrial, commercial, and banking establishments among many others.

The city is widely known as an educational and cultural center. Educational institutions in St. Paul include the University of Minnesota (q.v.), the International Institute, Hamline University (Methodist; 1854), Macalester College (1874), College of Saint Catherine (1905), College of Saint Thomas (1885), Bethel College and Seminary (Baptist), Concordia College (Lutheran), Saint Paul Bible College, William Mitchell College of Law, Lakewood Junior College, the Technical Vocational Institute, Luther Theological Seminary, Saint Paul Seminary (Roman Catholic), and United Theological Seminary. Cultural facilities include the St. Paul Public Library, with 650,000 volumes, the James J. Hill Reference Library, the Minnesota Historical Society, the Arts and Science Center, and the Minnesota Museum of Natural History. The city is governed under the commission system, with a mayor, a comptroller, and six councilmen heading the departments of government.

Commerce and Industry. The city is an important commercial and distribution center and one of the most varied industrial and manufac-

SAINT PAUL'S CATHEDRAL

turing cities in the United States. With Minneapolis, St. Paul is part of the fourth-largest electronics center in the U.S. The St. Paul area ranks second in the nation as a livestock market, fourth in printing and publishing, and fifth in manufacture of cosmetics. Other major industries are petroleum refining, brewing, and the manufacture of tapes and abrasives, hoisting equipment, detergents, fire pumps, and computers.

History. The site of St. Paul was first settled in 1838. In 1841 Father Lucian Galtier, a Roman Catholic missionary, built a log chapel in the settlement and dedicated it to Saint Paul (q.v.). The town was platted in 1847 and incorporated in 1849. In the latter year the first legislature of the Territory of Minnesota met in St. Paul, which was made the capital of the Territory and retained that status when Minnesota became a State in 1858. Chartered as a city in 1854, until about 1890 the economy of St. Paul depended largely on trade and transportation. Thereafter, however, manufacturing began to develop and the city achieved its position as an educational and cultural center.

Population. Between 1910 and 1950 the population of St. Paul increased from 214,744 to 311,349. In 1960 the population was 313,411, and in 1970 it was 309,980.

SAINT PAUL'S CATHEDRAL, cathedral of the Church of England, in London. It was designed by the British architect Sir Christopher Wren (q.v.), and is one of the most famous churches in Europe. The cathedral was constructed between 1675 and 1710 on the site of an older church that was destroyed in the great fire of 1666. The plan is a Latin cross more than 500 ft. long and more than 100 ft. wide. The building

has a colonnaded and pedimented front two stories high; the magnificent dome at the crossing, which rests on a colonnaded drum, reaches a height of 384 ft. Famous Englishmen buried in St. Paul's include the admiral Horatio Nelson, the painter Sir Joshua Reynolds, the soldier Arthur Wellesley, 1st Duke of Wellington (qq.v.), and Wren.

SAINT PAUL'S SCHOOL, private secondary school of England, founded in 1509 by the English classical scholar and theologian John Colet (q.v.), dean of Saint Paul's Cathedral (q.v.), London. The first schoolhouse, erected in St. Paul's churchyard, was destroyed by fire in 1666. The school was rebuilt in 1674 and again in 1824. In 1884 new school buildings were erected in Hammersmith, a borough of London, and in 1968 the school was moved to Barnes, a southwestern suburb of the city. Among its former students were such Englishmen as the poet John Milton, Samuel Pepys the diarist, the military commander John Churchill, 1st Duke of Marlborough, and Major John André the British soldier and spy of the American Revolution (qq.v.). In 1969-70 about 620 pupils attended St. Paul's School.

SAINT PETER'S BASILICA, Roman Catholic church in Vatican City, Italy, adjacent to the Palace of the Vatican, and known as the world center of Roman Catholic worship. It is used by the pope to celebrate important masses and on other major occasions. The present structure superseded a 4th-century basilica that was built under the Roman emperor Constantine I (q.v.) on the site of the tomb of the Apostle Peter (q.v.). Work on the new church began in 1450, and in 1506 the plan of the Italian architect Bramante was accepted by Pope Julius II (qq.v.).

The Basilica of Saint Peter, adjoining the Vatican in Rome.
UPI



The basilica was to be a Greek cross, with a dome surmounting each arm. After the death of Julius II, the work was continued by the Italian artists Raphael (q.v.) and Giuliano da Sangallo (1445–1516). In 1547, the Italian Renaissance sculptor and architect Michelangelo (q.v.) was given control of the project. He designed a number of chapels and apses and planned the great central dome, which was completed after his death by the Italian architect Giacomo della Porta (1541–1604). In 1606, the form of the building was changed to a Latin cross by the Roman architect Carlo Maderno (1556–1629), who lengthened the nave and constructed the facade. In 1667 the Italian artist Giovanni Lorenzo Bernini (q.v.) built the vast colonnade that surrounds the forecourt of the church, the Piazza di San Pietro.

Saint Peter's Basilica is the largest Christian church in the world. The central dome rises more than 400 ft. above the pavement, and the long nave is closed by a bronze baldachino, or canopy, 95 ft. high, designed by Bernini. Beneath the altar is a crypt containing the tomb of Saint Peter. The church contains many outstanding examples of Renaissance and baroque (qq.v.) art, including the "Pietà", a sculpture (1498) by Michelangelo.

SAINT PETERSBURG, city and port of Florida, in Pinellas Co., on the s. tip of a large peninsula that separates Tampa Bay and the Gulf of Mexico, 18 miles s.w. of Tampa. Three bridges cross Tampa Bay to connect the city with the Florida mainland. Saint Petersburg is a popular winter resort, and is known for its extensive beaches and parks, which occupy a waterfront 33 mi. long. It is the home port of a large commercial fishing fleet; manufactures include fishing equipment and food products. Founded in 1876, St. Petersburg was incorporated as a city in 1903. It first gained prominence during the Florida land booms of 1911 and 1924. Pop. (1960) 181,298; (1970) 216,232.

SAINT PETERSBURG, capital of czarist Russia. See LENINGRAD: *History*.

SAINT-PIERRE, town on the island of Martinique, French West Indies, in the Caribbean Sea, 11 miles n.w. of Fort-de-France. Now a tourist center, the town was founded in 1635 near the base of the volcano Mont Pelée (q.v.). It was the largest and most important city on Martinique until Mont Pelée erupted in May, 1902, killing all but one of the estimated 30,000 residents of the town. Saint-Pierre never recovered; those who reside there now occupy dwellings among the ruins. A museum of volcanology has been established in the town. Pop. (1968) 6668.

SAINT-PIERRE, Jacques Henri Bernardin de. See BERNARDIN DE SAINT-PIERRE, JACQUES HENRI.

SAINT PIERRE AND MIQUELON, overseas department of France, in the N. Atlantic Ocean, 10 miles s. of Newfoundland, Canada. It consists of two small groups of islands with a total area of 93 sq.mi. The main islands are St. Pierre, Miquelon, and Langlade, the latter two connected by a low, sandy isthmus. The islands are mostly barren and rocky, but are of great importance as a center for cod fishing. In the mid-1970's the department's annual exports, mainly marine supplies, cattle, and fish, were valued at about \$13,353,000. The principal town is St. Pierre on the southernmost island. Maritime climatic conditions prevail, but are made more severe by the cold Labrador Current (q.v.) flowing past the islands from the N.

The population (1974 census, 5840) is largely descended from French settlers. The people enjoy full French citizenship. The department is governed by a prefect representing the president of France and a general council composed of fourteen popularly elected members. The department is represented in the French parliament by one senator and one deputy, both elected.

The Portuguese explorer João Alvarez Fagundes is believed to have discovered the islands in 1520. The first permanent settlement was made by French fishermen in 1604. In 1713, following a British victory in Queen Anne's War, France ceded St. Pierre and Miquelon to Great Britain. By the Treaty of Paris of 1763 they were returned to France. Thirty years later, during the Napoleonic Wars, they were seized by Great Britain, but were permanently restored to France by the Treaty of Paris in 1814. During World War II the Free French troops of General Charles de Gaulle (see DE GAULLE) occupied the islands.

SAINT-SAËNS, (Charles) Camille (1835–1921), French composer, pianist, and organist, born in Paris. He made his debut as a pianist at the age of ten and later studied at the Paris Conservatory. In 1853 he composed his first symphony, and from 1858 to 1877 he was organist at the Church of the Madeleine in Paris. His most famous work, the opera *Samson et Dalila*, was composed in 1877. During the last part of his life Saint-Saëns traveled widely in North Africa and the Americas. His music, which is written in the classical French tradition, is elegant and precise in detail and form and combines the lyrical style common to 19th-century French music with a more formal quality. Among his other works are the symphonic poems *Le Rouet d'Omphale* ("Omphale's Spinning Wheel", 1871) and *Danse*

SAINT-SIMON

Macabre ("Dance of Death", 1874), the Third Symphony in E flat minor (1886), and the suite for orchestra with two pianos, *Le Carnaval des Animaux* ("Carnival of the Animals", 1886).

SAINT-SIMON, Comte de, Claude Henri de Rouvroy (1760–1825), French socialist, born in Paris. At the age of sixteen he went to the United States to fight in the American Revolution. When he returned to France, he supported the revolution there, giving up his title. He is considered to be one of the founders of modern socialism (q.v.). His writings present arguments in favor of a social organization directed by men of science and industry for the benefit of the whole society. The students of Saint-Simon organized and popularized his ideas after his death, and his principles became known as the philosophy of Saint-Simonianism. His major work is *Le Nouveau Christianisme* ("The New Christianity", 1825).

SAINT-SIMON, Duc de, Louis de Rouvroy (1675–1775), French writer of memoirs, born in Paris. He served in the French army until 1702, when he established himself at the court of Louis XIV (q.v.) at Versailles. Because of his quick temper and sharp tongue, he was unpopular with the king and consequently held only minor positions at court. Saint-Simon's observations of court life, together with contemporary journals and memoirs, formed the basis of his *Mémoires*, written between 1739 and 1751 and published in 1788. His account of the court of the French monarch is a classic of French prose

and a detailed study of that period in French history. The work is especially notable for its vivid character sketches. Selections from the voluminous work appeared in an English translation in 1958.

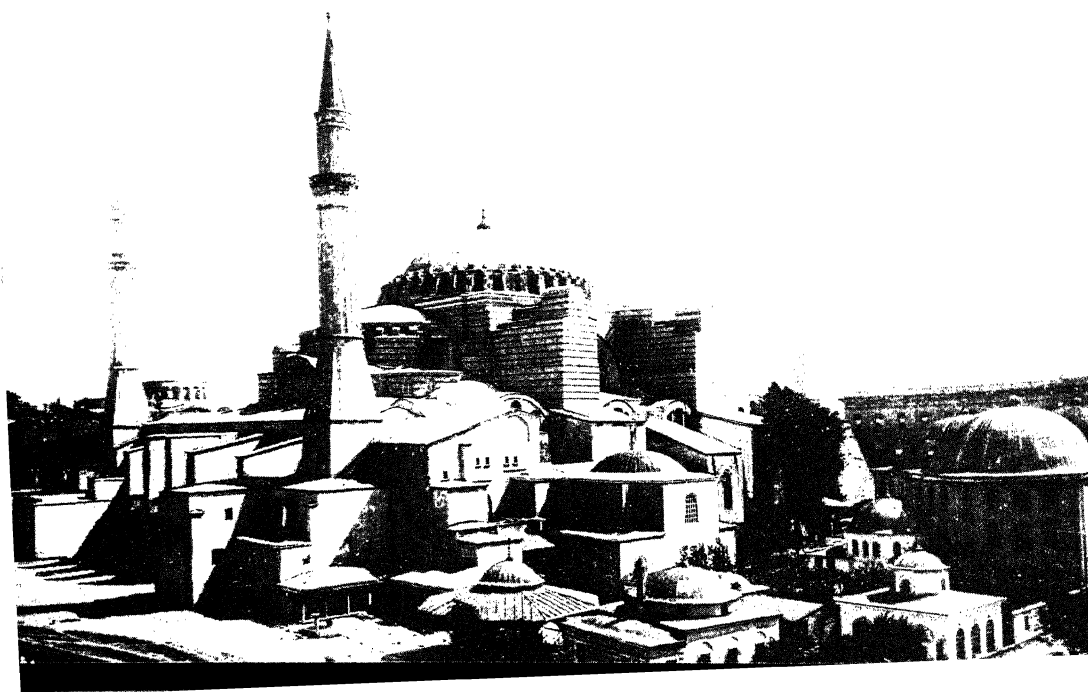
SAINT SOPHIA or SANTA SOPHIA, museum of Byzantine art in İstanbul, Turkey, formerly a mosque, and originally the Christian Church of the Divine Wisdom (Gr., *Hagia Sophia*). It was built between 532 and 537 by the Greek architects Anthemius of Tralles (fl. 6th cent.) and Isidorus of Miletus (fl. 6th cent.) at the command of the Byzantine emperor Justinian I (q.v.). The outstanding feature of the edifice is the great central dome, 102 ft. in diameter and 184 ft. high, carried on pendentives that are borne by four huge arches; see **DOME**. Around the base of the dome are forty arched windows. All of the interior is covered with marble and gold mosaic. After the Turkish conquest of Constantinople (now İstanbul) in 1453, the church was converted to a mosque. Four minarets were erected at the corners of the edifice and the interior was whitewashed to obliterate the Christian decorations.

Saint Sophia represents the greatest achievement of Byzantine art (q.v.), and the designs of many mosques in Constantinople and other Turkish cities were based on its design; see **ISLAMIC ART AND ARCHITECTURE**. The building has been secularized, and the whitewash has been removed from the mosaics.

SAINT THOMAS. See **VIRGIN ISLANDS OF THE UNITED STATES**.

SAINT THOMAS. See **SÃO TOMÉ AND PRÍNCIPE**.

The west side of Saint Sophia, in İstanbul, Turkey.



SAINT THOMAS NATIONAL HISTORIC SITE.

See NATIONAL PARK SERVICE.

SAINT VALENTINE'S DAY, February 14, a holiday honoring lovers. It is celebrated by the custom of sending greeting cards or gifts to express affection. The cards, known as valentines, are often designed with hearts to symbolize love. The holiday probably derives from the ancient Roman feast of Lupercalia (Feb. 15), for which young Roman men and maidens drew partners for the coming year by lottery. The festival gradually became associated with the feast day (Feb. 14) of two Roman martyrs, both named Saint Valentine, who lived in the 3rd century. Saint Valentine has traditionally been regarded as the patron saint of lovers. The holiday is also associated with the legend that birds choose their mates on this date.

SAINT VINCENT, island in the Caribbean Sea, one of the Windward Islands, politically a member of the West Indies Associated States; see WEST INDIES, THE. The island is situated between about lat. 13°10' N. and lat. 13°20' N. and long. 61°10' W. and long. 61°18' W. The island is traversed from N. to S. by a chain of volcanic mountains which rise to 4049 ft. in the volcano Soufrière. The average annual temperature is about 75° F. The area is 150 sq.mi. The population (1960 census) was 79,948; the United Nations estimated (1971) 90,000. Saint Vincent has a population density of 600 per sq.mi. (U.N. est. 1971). Kingstown (pop., 1972 est., 22,000) is the capital. Saint Vincent and Grenada share the administration of the Grenadine Islands. The population consists primarily of Blacks, and English is the official language.

The chief agricultural products are bananas, arrowroot, and sweet potatoes. Secondary products include nutmeg, mace, cocoa, cotton, and various food crops. Exports in the early 1970's amounted to some \$7,000,000 annually. The island received associated status from Great Britain in 1967, granting it full internal self-government, under the administration of Hywel George (1924-). Foreign affairs and defense remain the responsibility of Great Britain. The insular government is headed by a chief minister, who is assisted by a cabinet. Saint Vincent's unicameral legislature, the House of Assembly, has thirteen elected members, three nominated members, and one official member.

The island was discovered by the Italian-born navigator Christopher Columbus (q.v.) in 1498 and settled by the British in 1762; it became a British colony in 1763.

SAINT VITUS'S DANCE or CHOREA, disease characterized by involuntary spasmodic move-

ments of muscles in the entire body, and especially the face and limbs. The disease usually causes emotional instability, depression, and irritability. It is commonly associated with rheumatic fever (q.v.). The causes of Saint Vitus's dance are not entirely known. The term originated in the Middle Ages, when afflicted people invoked the aid of the Christian child martyr Saint Vitus (d. late 3rd cent.).

Saint Vitus's dance chiefly affects children between the ages of seven and fourteen and is more frequent in girls than in boys. The disease generally lasts for six to eight weeks, usually followed by automatic recovery. Treatment involves bed rest and the administration of sedatives.

SAIPAN, island of the Pacific Ocean, second largest of the Mariana Islands (q.v.), about 150 miles N.E. of Guam. It is approximately 47 sq.mi. in area. Tanapag, the chief town, is located on the W. side of the island. The principal industry of Saipan is the cultivation of sugarcane. Coconuts, coffee, and tropical fruits are also grown and exported. During World War II, the island was captured by United States forces in 1944, and it was used as a base for air attacks against the Japanese mainland. Saipan is the headquarters of the U.S. High Commissioner of the Trust Territory of the Pacific Islands. Pop. (1970) 7967.

SAKAI, city of Japan, on the island of Honshu, on Osaka Bay, 6 miles S.W. of Osaka. Major industries include the manufacture of chemicals, machinery, cutlery, and textiles. In the 16th century, Sakai was a major inland seaport. It declined because of the silting of its harbor. Today Sakai is part of the Osaka (q.v.) industrial belt. Pop. (1970) 594,000.

SAKE or SAKI, fermented rice beer (q.v.), native to Japan and usually consumed hot or warm; see BREWING; FERMENTATION. Sake is sometimes referred to as rice wine because of its high alcoholic content, which varies from 14 to 18 percent. The brewing process, which is many centuries old, lasts about six weeks and starts with the mixing and kneading together of steamed rice, called koji, with a cultivated mold and water. This mixture is heated and then fermented in large vats, sometimes in the presence of a yeast. Contamination of this brew is prevented by the addition of lactic acid (q.v.), and the liquor is then filtered.

SAKHALIN, formerly SAGHALIEN (Jap. *Karafuto*), island of the Soviet Union, in the Russian S.F.S.R., in the Sea of Okhotsk, separated from the E. coast of the Soviet Union by the Tatar Strait and from the Japanese island of Hokkaido to the S. by La Pérouse Strait. Mountain ranges

traverse the island from N. to S., and the chief rivers are the Poranay and the Tym. Sakhalin is 600 mi. long from north to south; the width is 15 mi. to 100 mi. Industries include fishing, mining, and lumbering. Oil and coal are the primary mineral products.

In 1855, the Russians and Japanese established a joint condominium over Sakhalin. According to the terms of the Treaty of Saint Petersburg (1875), however, Japan relinquished its claims to Russia in exchange for the Kuril Islands (q.v.). In 1905, at the close of the Russo-Japanese War (q.v.), Sakhalin was divided between the Japanese and the Russians. The portion of the island S. of lat. 50° N. was assigned to Japan, and the remainder to Russia. In 1945, following World War II, the entire island again became a possession of the U.S.S.R.

SAKHAROV, Andrei Dmitrievich (1921–), Soviet nuclear physicist and winner of the Nobel Peace Prize.

Born in Moscow on May 21, 1921, he graduated from Moscow State University in 1942 and continued his studies during World War II, taking his doctorate in physics at the P. N. Lebedev Institute in 1947. From 1948 to 1956 he did research in controlled nuclear fusion, and, with Igor Tamm (q.v.), made a proposal that led to the construction of the Soviet hydrogen bomb. In 1953 he became a member of the Academy of Sciences of the Soviet Union. After 1961, when he made a formal protest against the atmospheric testing of a hydrogen bomb by the U.S.S.R., his activities were increasingly directed toward political questions and less toward science. By 1968, he had virtually abandoned scientific research, becoming instead a spokesman for civil liberties in the U.S.S.R. and for international disarmament and nuclear weapons control. For these activities Sakharov was awarded the 1975 Nobel Peace Prize, but the Soviet government would not permit him to go to Norway to accept it.

SAKI. See MONKEY.

SAKI, pen name of Hector Hugh Munro (q.v.). **SALADIN,** or (Arab.) SALĀH-AL-DĪN, YŪSUF IBN-AYYŪB (1138–93), Sultan of Egypt and Syria, born in Tikrit, Mesopotamia. He succeeded his uncle as grand vizier of Egypt in 1169, and in 1171 he overthrew the dynasty of the Fatimids (see CALIPH). In 1175 Saladin became the first Ayyubid sultan of Egypt and Syria. His Muslim armies defeated Christian forces near Tiberias in 1187. His subsequent capture of Acre and Jerusalem led to the Third Crusade; see CRUSADES: *Third Crusade* (1189–92).

SALAMANCA, city in Spain, and capital of

Salamanca Province, on the Tormes R., 105 miles N.W. of Madrid. Industries include agricultural trade, food processing, and the manufacture of chemicals, pottery, leather, jewelry, and furniture. The city was captured by Hannibal (q.v.) in 222 B.C. The focal point of the city is the Plaza Mayor, which is considered one of the most beautiful squares in Europe. The Universidad de Salamanca, founded about 1230, was a famous university during the Middle Ages and Renaissance. It ceased to exist in the 19th century but was reactivated in 1940. A Roman bridge crosses the Tormes. Also in the city is the Universidad Pontificia de Salamanca, founded in 1940. The city has two cathedrals: the old cathedral, dating from the 12th century, which is richly decorated with paintings and monuments; and the new cathedral, which dates from the 16th century. Pop. (1970) 125,220.

SALAMANCA, UNIVERSITY OF, officially UNIVERSIDAD LITERARIA DE SALAMANCA, state institution of higher learning, located in Salamanca, Spain. It is under the jurisdiction of the ministry of education and is supported by the national government. The university was founded about 1230 by King Alfonso IX, King of León (see under ALFONSO), as a royal university and reorganized by Alfonso X (q.v.), King of León and Castile in 1254. The institution reached the height of its influence during the 16th century, when it had about 6800 students. It declined subsequently, along with the other Spanish universities.

Reactivated in 1940, the university consists of the faculties of philosophy and letters, law, science, and medicine, as well as several affiliated institutions. The *licenciado* is awarded after five to seven years of study, and is the equivalent of an American baccalaureate degree. The doctorate, the equivalent of an American degree of master, is awarded after an additional one to two years of study and the completion of a thesis. The libraries contain about 240,500 bound volumes as well as collections of incunabula, rare books, and manuscripts. In the early 1970's the student body numbered about 10,000 and the faculty, about 500.

SALAMANDER, common name applied particularly to amphibia of the genus *Salamandra*, typical of the family Salamandridae. The salamanders only inhabit water in their tadpole state and return to it merely to deposit their eggs; they generally live in moist places, such as under stones and the roots of trees. They feed on worms, slugs, snails, and other small creatures. In habit they are somewhat sluggish and shy. The spotted land salamander, *S. maculosa*,

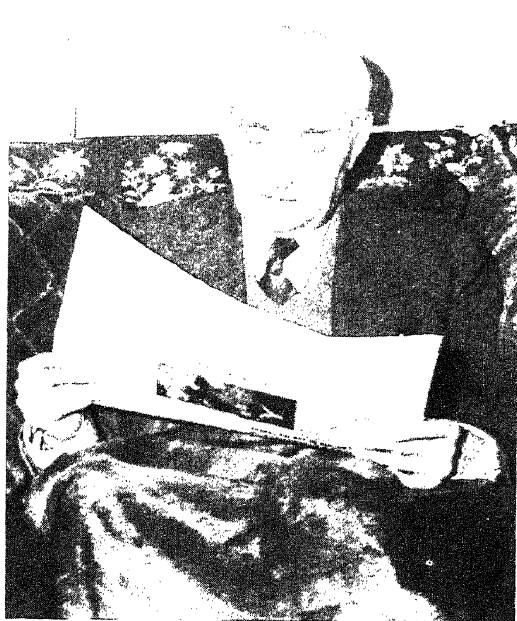
is common in Europe. It is 6 to 8 in. long, and is conspicuous with bright yellow patches on a blackish background. The black salamander, *S. atra*, lives in the Alps, and is viviparous. Other species are found in Spain and Italy, and in Asia. The genus *Salamandra* is not represented in the United States, where salamander is the common name for many amphibians of the order Caudata, including the families Ambystomidae, Plethodontidae, and other members of the family Salamandridae. See AMPHIBIA.

SALAMIS, island of Greece in the Saronic Gulf, an arm of the Aegean Sea, off the coast of Attica, about 10 miles w. of Athens. The island produces wheat, olive oil, and wine; fishing is also a major industry. According to the Greek epic poet Homer (q.v.), Salamis was the home of the Greek legendary heroes Ajax and Teucer (qq.v.). It was the object of a conflict between Megara and Athens and was taken by the latter in the 6th century B.C. The strait between Salamis and the Grecian mainland was the site of the Greek naval victory of the Athenian statesman Themistocles over Xerxes I (qq.v.), King of Persia in 480 B.C.; see GREECE: *History*. Salamis fell to Macedonia in 318 B.C. but returned to Athenian control in the following century. The modern port town of Salamis is the largest town on the island. Area, about 39 sq.mi.; pop. (1971) 18,425.

SAL AMMONIAC. See AMMONIA.

SALAZAR, Antonio de Oliveira (1889–1970), Portuguese economist and statesman, born near the town of Santa Comba Dão, and educated at the University of Coimbra. He became a lecturer in economics at the University of Coimbra in 1914 and attained the rank of professor in 1918. Soon after a military junta headed by the Portuguese general and statesman Antonio Oscar de Fragoso Carmona (q.v.) seized control of Portugal's government in 1926, Salazar was offered the post of finance minister to reform the nation's chaotic economy. He refused the post, when his demands for extraordinary powers were refused. In 1928, however, upon being promised these powers, he accepted the appointment. Within a year he had balanced the national budget and soon thereafter had liquidated the entire foreign debt. He was appointed prime minister in 1932 and during the next thirty-six years was the virtual dictator of Portugal. In 1933 he promulgated a constitution that established Portugal as a corporative state with one-party government. In addition to holding the portfolio of finance minister until 1940, he served as minister of war (1936–44), of foreign affairs (1936–47), and of defense (1961–62).

Salazar maintained his position by obtaining



Antonio de Oliveira Salazar

Pix, Inc.

the support of wealthy landowners, bankers, and industrialists and by suppressing trade unions, the press, and all political opposition with the aid of his security police. In addition to resisting social and political change at home, he sent large numbers of troops to the Portuguese possessions in Africa to stem rising nationalism. Salazar held the national economy stable, however, and under his rule Portugal enjoyed moderate prosperity. He supported General Francisco Franco (q.v.), later dictator of Spain, in the Spanish Civil War; and after the war the two leaders often met to discuss political questions. Salazar kept Portugal neutral during World War II. He was a strong supporter of the Roman Catholic Church; and in 1940 he signed a concordat with the Vatican that restored property confiscated from the Church by a previous government. He suffered a stroke in 1968 and was replaced as prime minister, although this fact was withheld from him during the nearly two years that he survived.

See PORTUGAL: *History: The Salazar Regime*.

SALE, agreement or contract by which real or personal property (q.v.) is transferred by a seller to a buyer for a price, in the form of money. A sale differs from a barter transaction in that the barter transaction does not involve the transference of money. In England and the United States a sale of goods or a contract to sell goods must, under the Statute of Frauds, be in writing if the value of the goods is in excess of a certain

SALE

minimum amount, unless there is partial payment of the purchase price, or delivery and acceptance of a part of the goods, or a memorandum subscribed by the party to be charged. The minimum amount varies; in New York State, for instance, it is \$500.

Types of Sales. A sale of real property must in all cases be in writing; see **TORRENS SYSTEM**. A sale on trial, on satisfaction, or on approval is one in which the goods are delivered to the buyer for examination and use; the buyer is a bailee of the goods, the title in the goods remains with the seller until the buyer indicates an intention to accept goods. Such a sale differs from one in which goods are sold with permission to be returned by the purchaser if they are unsatisfactory; in the latter situation there is an immediate transfer of the title in the goods to be purchased. A conditional sale is one in which the title to the goods is not transferred to the purchaser until some particular condition has been satisfied, such as the sale of an automobile in which payment is made in installments, with the title not being transferred until the final installment has been paid.

Legal Suits. A seller who is unpaid may sue the purchaser for the price of the goods. Likewise if the goods have not been accepted by the purchaser, the seller may sue for damages (q.v.) for nonacceptance; the measure of damages is the difference between the market value and the contract price. A buyer, on the other hand, who fails to receive the goods purchased or contracted for may sue the seller for damages for breach of contract, or may bring an action for specific performance.

Warranties. In every sale certain implied warranties are imposed by law on the seller. In England such warranties are imposed under the Sale of Goods Act, and in the U.S. under the Uniform Sales Act, which is in force in most States, and by court decisions in other States. A seller of goods warrants by implication that he has title or a right to sell the goods, that there are no encumbrances or liens (see **LIEN**) on the goods, and, when goods are sold for a particular purpose, that they are fit to be used for such intended purpose. Goods are sold by description or by sample with an implied warranty that they are merchantable, that is, not defective in quality and conforming to the sample or description. A seller may also make express warranties as to the goods sold; for example, in the case of a sale of textiles, a warranty may be expressed that the goods be of a specified construction. A breach of warranty, express or implied, gives the purchaser the right to bring an action for breach of

contract against the seller to recover damages resulting from the breach; or the purchaser may rescind the contract to sell, or the sale, and refuse to receive the goods. If the purchaser knew, however, of the breach of warranty when he accepted the goods, he may not rescind the contract and recover the purchase price paid. For personal injuries suffered as a result of defects in the manufacture of a product, the purchaser may bring action against the manufacturer for negligence (q.v.), or for a breach of warranty if the injuries resulted directly from such breach.

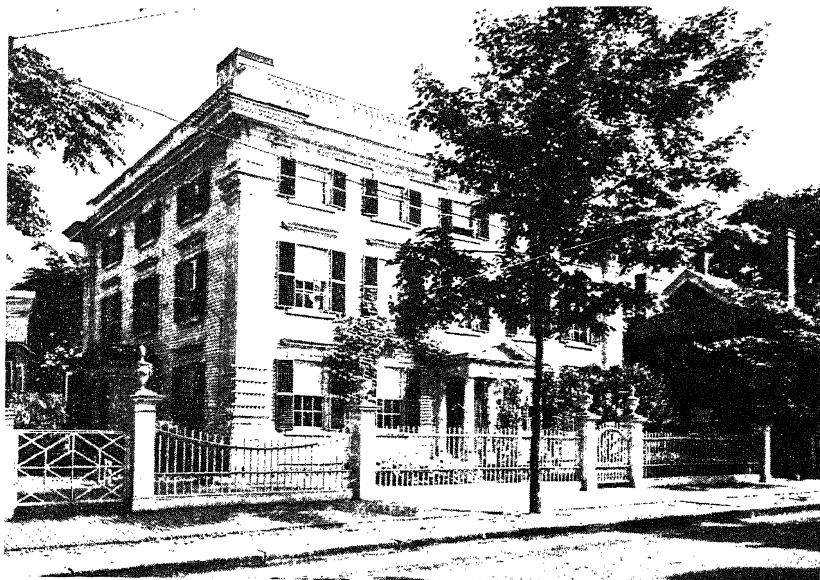
Shipment and Contracts. Goods sold may be shipped to a purchaser on a C.O.D. (cash on delivery), F.O.B. (free on board), or C.I.F. (cost, insurance, and freight) basis. In a C.O.D. contract the goods are shipped to the purchaser, and title passes immediately to the purchaser; if the goods are shipped by a carrier, title passes to the buyer when the goods are received by the carrier. In an F.O.B. contract, the purchaser pays transportation charges from the point at which the goods are delivered to the carrier, and title passes to the purchaser when the goods are delivered to the carrier. In a C.I.F. contract, in which the purchase price includes the cost of the goods, insurance on them, and delivery charges to their place of destination, title passes to the purchaser at the point where the goods are shipped. The place where and the time when title passes to the purchaser are of importance because, as a general rule, the risk of loss resulting from loss or destruction of the goods must be borne by the one who has title to the goods.

In the U.S. a sale of the entire stock and fixtures of a business, to be valid, must conform with the statutory provisions of the bulk sales acts of the various States; see **STATUTE**. Generally the requirements are that an inventory of the stock be taken some days before the sale and that creditors be notified of the sale; see **CREDIT**. Unless the provisions of the statute are complied with, the buyer is liable to the creditors of the seller.

See also **CONTRACT**.

SALE, city and port of Morocco, at the mouth of the Bou Regreg R. on the Atlantic Ocean, opposite Rabat, with which it is connected by a bridge erected in 1957. The city is an important port; its industries include flour milling, carpet weaving, fish canning, cork processing, and pottery making. Among points of interest are old walls and gates, religious shrines, the Great Mosque (12th century), and the Medersa, a school founded in 1333. Founded by Berbers in

Peirce-Nichols House in Salem, Mass., built in 1782 from designs by the American architect and wood carver Samuel McIntire (1757-1811), called the "architect of Salem".
Essex Institute



the 11th century, the city was developed under the Merinid dynasty of the 13th century. About 1630 it became a semi-independent pirate republic, the home of the "Sallee rovers". Pop. (1971) 155,557.

SALEM, city and port in Massachusetts, one of three seats of Essex Co., on a peninsula in Massachusetts Bay, 16 miles N. of Boston. Leading industries include electronics, printing and publishing, and the manufacture of leather and leather products, machinery, paper, chemicals, and plastics. Points of interest include the House of Seven Gables (1668), the birthplace of the American novelist Nathaniel Hawthorne (q.v.), the Peabody Museum, Essex Institute, and Pioneer Village, a reproduction of a Puritan (see PURITANS) community. Other buildings of literary, maritime, and architectural interest are maintained as part of the Salem Maritime National Historic Site. Salem was settled in 1626. The famous witchcraft (q.v.) trials, which led to the execution of twenty persons, were held here in 1692; see DANVERS. The city grew as a prosperous port and world trade center until about 1850. Manufacturing developed in the late 19th century. A large part of the city was destroyed by fire in 1914. Pop. (1960) 39,211; (1970) 40,556.

SALEM, city in North Carolina. See WINSTON-SALEM.

SALEM, city of Ohio, in Columbiana Co., about 18 miles s.w. of Youngstown. Manufactures include machinery, steel, and household appliances. The city was settled by Quakers in 1801, and later was part of the Underground Railroad. Pop. (1960) 13,854; (1970) 14,186.

SALEM, city and capital of Oregon, and county seat of Marion Co., in Marion and Polk counties, on the E. bank of the Willamette R., 45 miles s.w.

of Portland. One of the busiest commercial centers of Oregon, Salem serves the agriculturally rich Willamette R. valley. The manufacture of lumber and wood products and food processing, especially fruit and berry canning, are major industries. Willamette University was established here in 1853. The Oregon State Fair is an annual event. The city houses the Salem Art Museum. Salem was founded in 1840 by Methodist missionaries who migrated over the Oregon Trail (q.v.) and settled in the Willamette R. valley; the new settlement flourished. Salem became the capital of the Oregon Territory in 1851, was incorporated as a city in 1857, and became the capital of the State of Oregon in 1859. Pop. (1960) 49,142; (1970) 68,296.

SALEM, independent city of Virginia, and county seat of Roanoke Co., on the Roanoke R., about 7 miles w. of Roanoke. Wheat, corn, hay, and apples are grown, and manufactures include machinery, wood products, and textiles. It is the site of Roanoke College, founded in 1842. The Dixie Caverns are nearby. Salem was incorporated in 1806. Pop. (1970) 21,982.

SALEM, city of the Republic of India, in Tamil Nadu State, 175 miles s.w. of Madras. The city is the focal point of the surrounding agricultural area. It is a major handloom-weaving center. Industries include the manufacture of textiles, cotton and silk apparel, and chemicals. Iron ore and magnesite deposits are found nearby. Pop. (1971) 308,303.

SALERNO (anc. *Salernum*), city and port of Italy, in Campania Region, and capital of Salerno Province, on the Gulf of Salerno, 30 miles s.e. of Naples. Industries include the manufacture of machinery, foodstuffs, and textiles. The cathedral was erected in the 9th century and re-

SALERNO, GULF OF

built in the 11th century. The city was celebrated in the Middle Ages for its medical school. Salerno was a Roman colony, called Salernum, in the 2nd century B.C. It became an independent principality in the 9th century A.D. Falling under Norman control in 1076, Salerno flourished under the reign of the Norman adventurer Robert Guiscard (q.v.). American forces established a base in Salerno after heavy fighting in World War II. Pop. (1971) 154,721.

SALERNO, GULF OF, inlet of the Tyrrhenian Sea, on the s.w. coast of Italy, separated from the Bay of Naples by the Peninsula of Sorrento. The gulf is almost semicircular in form, with the cities of Amalfi and Salerno on its n. shore.

SALESMANSHIP, promotional function of the marketing process. Other promotional functions are advertising, often called mass salesmanship, and sales promotion, sometimes called merchandising. These functions focus on customers and prospective customers. Because salesmanship most often takes the form of a face-to-face interview between buyer and seller, it is the most costly form of promotion, but its effectiveness justifies the costs. A competent salesman, in the presence of a prospective buyer, is able to observe and react to signs of interest or disinterest; his presentation develops in a manner to convince the prospect that the product being offered is essential to his satisfaction. The inability to achieve this so-called feedback between the buyer and seller is a chief weakness of advertising, which cannot be so carefully adapted to the individual. Selling by telephone, which is less effective than personal selling, is still more effective than advertising and has become a usual method of salesmanship.

None of these promotional activities is used only by business; religious, charitable, governmental, educational, and other social institutions also employ to advantage the methods and techniques of salesmanship. Salesmanship is, however, most usually associated with business, in which it finds expression on many levels. At one extreme are the salesmen who call from door to door in office buildings, offering supply items. At another extreme are technically trained and experienced engineers selling installations of whole production systems to committees of professional purchasing agents. The leasing of equipment and supplies, particularly to industry, calls for salesmanship, and the same skills are applied in the distribution of securities or the transfer of real estate.

Types of Salesmen. The variety and complexity of markets suggest the need for different

personalities and abilities among salesmen. Salesmen may be divided into four broad categories: manufacturers' salesmen, wholesalers' salesmen, retailers' salesmen, and specialty salesmen.

Manufacturers' salesmen are of three types. The most specialized and highly paid are those who produce new accounts and promote new products. The second group includes salesmen who regularly call on existing accounts and maintain customer goodwill, taking orders to replenish inventories. For his employer, this salesman reports customer attitudes, competitive action, and other territorial developments. The so-called missionary salesman, who does various kinds of promotion work with customers, is the third category of manufacturers' salesman. Missionaries call upon physicians, architects, and engineers, who greatly influence the purchase of pharmaceuticals or construction materials. Where consumer goods are sold through wholesalers to retailers, the manufacturer's missionary assists the retailer with suggestions that will increase the sales of the product.

Wholesalers' salesmen include men who regularly call upon retail customers to offer merchandising advice and other services. Often they suggest additional products that might profitably be included on the retailer's shelves. The wholesaler's salesman generally must collect payment for previous shipments and must keep his principals informed of conditions in his sales territory.

The extent of persuasion used by in-store retail salesmen varies greatly in different businesses. In a supermarket, a salesman may merely answer shoppers' occasional questions, but in the retailing of furniture and large appliances, a salesman must apply highly specialized knowledge and skills.

Specialty salesmen, often called creative salesmen, are involved in the distribution of products and services that are either high in price, complex and technical, or relatively unknown to the prospective purchaser. Types of specialty salesmen include sales engineers, who usually must have a technical education; business-equipment salesmen; life-insurance salesmen, security salesmen, salesmen who sell consumer items door to door, and encyclopedia salesmen.

Sales Management. This aspect of selling involves the total sales program of an organization, including establishing objectives, developing and carrying out plans, and evaluating sales performance. The sales manager is usually responsible to the marketing manager and often

shares revenue-producing responsibility with an advertising manager and a sales-promotion manager. The sales manager occupies the role of middleman between personnel of the sales department and other management officials. He has responsibility for the entire personal-salesmanship program of the organization. The sales manager also contributes to the policy-making functions of the business, providing knowledge of markets and competition and estimates of sales potential. His forecast of sales is the basis for the company budget.

Methods of recruiting salesmen vary from firm to firm, even within a single industry. During the selection of salesmen or trainees, an applicant may be subjected to several interviews. Psychological tests are not generally used except by the largest employers of salesmen and are thought to be useful only if the corporation has had several years of experience with them. Package tests, however, are sometimes used to supplement a program of interviews.

History of Salesmanship. In Europe before the 19th century, surpluses of crops and products were small and were shared locally or were offered to consumers at local fairs and markets. Market day is still important in selling crops and handicrafts in some less developed economies. The traveling salesman appeared late in the 19th century both in Europe and in the United States. One sort of traveling salesman was the itinerant peddler who carried his goods on his back or on his horse, working his way from a port city through the hinterlands, appreciated as much for the news he brought as for the bargains he offered. Another traveling salesman was the dockside greeter, meeting buyers who came periodically to the port city to buy goods for their country stores. At dockside or in lavish hotels, these salesmen used hospitality devices to sell warehouse-stored imports and the increasing number of products from domestic factories. With the coming of the railroad and the assurance given to sellers by credit-reporting systems, salesmen with their sample cases moved across the land.

Sales Procedures. Persuasive skill was less important in those days of unsatisfied demand, and orders were readily forthcoming. By 1900, however, with the increasing supply of manufactured goods and of money crops, buyers became increasingly discriminating in their purchases. More attention was given, therefore, to selecting and training salesmen. With the development of national magazines, advertising supported the efforts of the salesman.

Psychologists as well as business leaders

began to take an interest in the processes of buying and selling. Courses in salesmanship, based largely on empirical experience and observation, first appeared in evening courses offered by the Young Men's Christian Association (Y.M.C.A.) and soon were listed in the catalogs of university business schools. These courses, acknowledging the importance of the buyer, offered techniques of buyer manipulation, stressing the importance of persistence. The potential salesman was provided with a standardized procedure that was supposed to lead to success in most of his encounters. Success was probably based as much on the natural adaptability of the experienced and usually extroverted salesman as on the formula and subsidiary techniques. The sales procedure included the following steps: (1) locating a prospect with apparent need and ability to buy; (2) learning about the prospect and verifying the estimate of his need and ability to buy; (3) gaining access to the prospective buyer; (4) attracting his attention and arousing his interest in the product and the satisfaction to be derived from its use; (5) stimulating his desire to possess the product, convincing him by answering his questions and meeting his objections with logical responses, and supporting all product claims with acceptable proof; and (6) encouraging and gaining his favorable decision.

The popularity of this series of steps was based on the fact that it seemed to work, regardless of the nature of the product or service being sold. If a prospective buyer remained unconvinced, the salesman was trained to regard this as an oversight in the presentation, which could be corrected by going back to an earlier step in the series and renewing the procedure. If the prospective buyer objected that he lacked funds or time to listen to the presentation, the salesman was to disregard these remarks as mere excuses. Persistence, reliance on the formula, and application of well-practiced techniques involving product display and verbal response would win the buyer.

Recent Developments. Since the early 1930's, behavioral scientists have found business in general a fertile field for their studies. Because salesmanship involves human relationships at a point of decision-making, the behavior and motivation of sellers and buyers are of special interest to behavioral scientists. Their investigations have modified methods of persuasion and have resulted in a fuller understanding of motivational behavior. Among these newer areas of comprehension are role expectations in the interaction between buyer and salesman, commu-

SALESMANSHIP

nication theory (including nonverbal expression), interpretation of feedback, the modified adoption process, group influence, and the theory of diffusion of innovation. These developments have changed the nature of salesmanship training and practices from reliance on structured step-by-step presentations and persistence to recognition of the salesman's role as a territorial representative charged with establishing and maintaining mutually profitable relationships. The sensitive and aware salesman now spends more time in learning of the buyer's interests and needs, applies greater proficiency in eliciting information, and has greater sensitivity to the environment, interests, and unknown as well as acknowledged needs of the buyer.

By 1950, courses in salesmanship had been eliminated from the catalogs of most university business schools, but had gained popularity as a high-school subject and were also widely studied in adult-education classes. The most skillful instruction in salesmanship, using behavioral-science concepts, is offered in the training sessions conducted by large corporations for their own personnel. The present-day salesman in training is still encouraged to persist diligently in acquiring profitable orders, to observe restraint in spending money, to know the conditions in his territory, to be aware of his competition, and to represent his company enthusiastically. His attitude toward the prospective customer has changed somewhat, with more emphasis on the problems of the buyer and less reliance on relentless persistence in a sales interview. Persuasion follows only after a need is made evident.

Despite this growing body of knowledge, a large number of salesmen, especially those who call on consumers, still rely on the older methods. Use of behavioral innovations is most often found in larger corporations, in which salesmen stimulate movement of products and services through professional buyers and buying committees.

Both the older and newer techniques of salesmanship are sometimes used by self-seeking persons or those with fraudulent intent. In spite of such abuses, however, skilled and honorable salesmen continue to provide buyers with the information and incentives to make decisions rather than defer them. Greater use of automatic machinery, continued growth of production, and new buyers with greater discretionary income assure the salesman a continuing important role. Even in retailing, in which the buyer approaches the sales counter with an acknowledged need and a supply of cash or

credit, the information that the salesman provides is still necessary, in spite of omnipresent advertising. Introducing innovations may be the function of advertising, but a salesman's skill is required to adapt a new product to the particular situation of the buyer.

H.W.M.

SALES TAX, tax imposed on the sale of goods or services. The tax is computed as a percentage of the total sales price. Sales taxes may be imposed either on the purchaser or on the seller; in the former case they are charged on each transaction and in the latter they are collected as a percentage of the gross receipts during a given period. A sales tax differs from an excise (q.v.) in that the sales tax is imposed on the sales transaction rather than on the article of commerce as such. In the United States, Congress has never enacted a sales tax. Such taxes are, however, common in the States and in municipalities. The first sales tax was adopted by Georgia in 1929. Subsequently, during the prolonged economic depression of the 1930's, many sales taxes were enacted as emergency means of raising revenue to meet relief needs. After the emergency ended most of the taxes were retained as a permanent feature of government financing.

The retail sales tax, which has been imposed by almost all of the States and the District of Columbia, is the most usual form of sales tax. The combined, or State-local, taxation rate for sales of goods and personal services generally ranges from 2 to 6 percent. See **TAXATION**.

SALFORD, Great Britain, county borough in Lancashire, England, on the Manchester Ship Canal and the Irwell R., adjoining Manchester on the w. A textile center, the city has electrical engineering plants and manufactures cotton textiles, textile machinery and chemicals, aniline dyes, plastics, steel, shoes, tires, and paint. Included within the city is the Trafford Park experimental industrial area, which produces refined oil and petroleum products, machinery, cement and concrete, wood products, and soap. Salford is the site of the world's first free municipal library and of Salford University, the former Royal College of Advanced Technology. Pop. (1971) 130,641.

SALIC LAW, code of laws, written in Latin, and first compiled early in the 6th century by the Salians, a Frankish race that conquered Gaul; see **FRANKS**. It comprises principally the fines to be paid for various injuries and crimes. Among its civil statutes, however, was one prohibiting women from inheriting private property. It is this aspect of the law to which the term Salic law is most often applied, primarily

because it mistakenly came to be employed as an argument against the succession of women, or of the descendants of kings' daughters, to European thrones. This Frankish land law was extended to the throne to prevent the crown from passing out of the country through the marriage of a woman to a foreigner. The Salic law in this respect was important in French history. It first was used in France early in the 14th century by Philip V, King of France (see *under* PHILIP). The law later formed the legal basis for the denial of the French crown to Edward III (q.v.), King of England, whose mother was a daughter of the French king Philip IV (q.v.); this dispute was the basis of the Hundred Years' War (q.v.). The Salic law as it evolved in regard to succession was the basis of claims to thrones in Spain, England, Italy, and Germany.

SALICYLIC ACID, white, crystalline solid that has the formula $C_6H_4(OH)COOH$. It is found in many plants, particularly fruits, in the form of methyl salicylate and is prepared industrially from phenol (q.v.). It has a somewhat sweet taste, is sparingly soluble in water and increasingly soluble in alcohol, ether, and chloroform, and has an m.p. 159° C. (318° F.). The acid is used chiefly in the preparation of several important esters (q.v.) and salts (see SALT, in chemistry). Sodium salicylate, prepared by treating the sodium derivative of phenol with carbon dioxide (q.v.), is used to some extent in preserving food and to a large extent in the preparation of mild antiseptic preparations, such as mouthwashes and toothpastes. The medicinal salicylic compounds, used as analgesics and antipyretics, are acetylsalicylic acid and phenyl salicylate, which are sold under the trade names aspirin (q.v.) and salol, respectively. The methyl derivative of salicylic acid, methyl salicylate, is the chief constituent of oil of wintergreen (see WINTERGREEN). Large quantities are made synthetically by the reaction of salicylic acid and methyl alcohol.

SALINA, city in Kansas, and county seat of Saline Co., on the Smoky Hill R., 91 miles n.w. of Wichita. It is the commercial center of a farming and stock-raising region. Industries include meat packing, the manufacture of aircraft, farm machinery, and fluorescent lamps, flour milling, and grain storage. Kansas Wesleyan University (1886), Marymount College (1922), a military school, and an air force base are located in the city. Salina was founded in 1858 and incorporated as a city in 1870. Pop. (1960) 43,202; (1970) 37,714.

SALINAS, city in California, and county seat of Monterey Co., in the lower Salinas Valley, 45

miles s. of San José and 100 miles s. of San Francisco. It is a market and shipping center for an irrigated farming and cattle-raising area. The valley produces lettuce, sugar beets, strawberries, and cotton. Industries in the city include vegetable and fruit packing and processing, sugar-beet refining, and the manufacture of lumber and wood products, electronic parts, paper and guayule-rubber products, ordnance, industrial equipment, and dairy products. Salinas is the site of Hartnell College (junior college; 1920) and the California Rodeo Field. Fort Ord Military Reservation is nearby to the s.w. The city is the center of a region described in some of the novels of the American writer John Steinbeck (q.v.), who was born here. Salinas was settled in 1856 and incorporated in 1874. Pop. (1960) 28,957; (1970) 58,896.

SALINGER, J(erome) D(avid) (1919–), American author, born in New York City. He was graduated from Valley Forge Military Academy and attended three colleges without receiving a degree. His most important work, *The Catcher in the Rye* (1951), established him as a leading American author. The hero of the book, Holden Caulfield, became a prototype of the rebellious and confused adolescent. Other works by Salinger are *Nine Stories* (1953), a collection of short stories, *Franny and Zooey* (1961), and *Raise High the Roof Beam, Carpenters; and Seymour:—An Introduction*, published in one volume in 1963.

SALISBURY, city in Maryland, and county seat of Wicomico Co., on the Wicomico R., about 69 miles s.e. of Annapolis. Salisbury is the center of a poultry-raising region, and is a popular fishing and hunting resort. Manufactures include boats, wood products, canned goods, and clothing. It is the site of Salisbury State College, founded in 1925. Settled about 1732, Salisbury was incorporated as a town in 1854 and chartered as a city in 1880. Pop. (1960) 16,302; (1970) 15,252.

SALISBURY, city in North Carolina, and county seat of Rowan Co., about 120 miles w. of Raleigh. It is the center of a considerable agricultural district. Major industries include the manufacture of cotton yarn, clothing, machinery, and metals. In Salisbury are a national cemetery and Livingstone College (1879). Founded in 1753, Salisbury was incorporated as a town in 1755, and chartered as a city in 1770. Pop. (1960) 21,297; (1970) 22,515.

SALISBURY, Great Britain, municipal borough of Wiltshire, England, in a valley near the confluence of the Avon, Bourne, Wylye, and Nadder rivers, 84 miles s.w. of London. Salisbury is an agricultural trade center. The foundation of

SALISBURY

Salisbury Cathedral was laid in 1220, when the town was founded. The spire, rising 404 ft., is the highest in England; see **CATHEDRAL**. The Blackmore Museum and several medieval churches are among the landmarks of the city. Nearby are Stonehenge (q.v.), a Bronze-Age monument, and Old Sarum, an Iron-Age hill fort. Pop. (1971) 35,302.

SALISBURY, city and capital of Rhodesia, on the Makabusi R. in the high veld area of Mashonaland, 230 miles N.E. of Bulawayo. The administrative, educational, and industrial center of the country and its road and rail hub, Salisbury covers an area of 134 sq.mi. Located in a livestock, farming, gold-mining, and fruit-growing area, the city is a major tobacco market. Industries include food processing, textile milling, tobacco processing, tanning, brewing, and the manufacture of textiles, apparel, chemicals, fertilizer, radios, furniture, plastics, concrete, and soap. The city is the site of the National Archives, a government research laboratory, the Queen Victoria Memorial Library (1902) and Museum, the Rhodes Centennial Art Gallery, a theater, and sports facilities. Educational facilities include the University College of Rhodesia (1957), a college of music, a polytechnic institute, and Saint George's (Jesuit) College. Founded in 1890 by the European "Pioneer Column" from South Africa, the community was called Fort Salisbury until the municipality was established in 1897. The city was chartered in 1935. It served as capital of the self-governing colony of Southern Rhodesia from 1923 to 1953, and of the Federation of Rhodesia and Nyasaland from 1953 to 1963. Pop. (1972 est.) 490,280.

SALISBURY, title in the English peerage held by members of the Cecil (q.v.) family.

SALISHAN FAMILY, linguistic family of North American Indians including the following tribes: Salish, Bellacoola, Pend d'Oreille, Clallam, Colville, Coeur d'Alène, Okinagan, Puyallup, Sanpoil, Shuswap, Songish, and Spokane; see **AMERICAN INDIANS: Indians of the United States and Canada: North Pacific Coast Area**. These tribes lived in British Columbia, Canada, and in the States of Oregon, Washington, Montana, and Idaho. Those living along the Pacific seaboard were primarily a fishing people and those in the interior relied more on hunting and ate roots and berries, although they also caught salmon in the streams.

Culturally, the coastal tribes differed from those of the interior, the former coming into greater contact with the neighboring tribes to the north, and the latter being influenced by other local stock in the hinterland. A structural

similarity between Salish, Chimakuan, and Wakashan languages is noticeable despite differences in vocabulary, and some resemblance to Algonquin also exists.

Salishan is comprised of two groups of dialects. The coastal dialects include Bellacoola and the Comox, Cowichan, Squawmish, and Sangish groups. The dialects of the interior include Lillooet, Ntlakyapamuk, Okinagan, and Flathead. See **AMERICAN INDIAN LANGUAGES**. Deformation of the heads of the infants by peaking, or artificially compressing the skull by means of a cone-shaped wicker headpiece, was prevalent among Salishan tribes, with the exception of the Salish, who thus became known as Flatheads; see **FLATHEAD**. The Salish, however, did not practice head flattening, which the Chinook (q.v.) did.

SALIVARY GLANDS, glands that secrete saliva, a somewhat alkaline fluid that moistens the mouth, softens food, and aids in digestion (q.v.). The largest of the glands, located around the mouth and leading into it, are the submaxillary, under the lower jaw; the sublingual, beneath the tongue; and the parotids, in front of each ear; the buccal glands, in the cheeks near the front of the mouth, also secrete saliva. Each of the glands secretes a slightly different kind of saliva; parotid saliva is nonviscous and free-flowing, sublingual saliva is sticky, and submaxillary saliva is thin and watery. The saliva of the parotid gland contains enzymes (q.v.) called amylases, one of which, known as ptyalin, aids in the digestion of carbohydrates (see **CARBOHYDRATE**).

True salivary glands exist in all mammals except the Cetacea (q.v.). In many animals the salivary glands have evolved unique functions. The saliva of vampire bats (see **BAT**) contains an anticoagulant, adapted to their diet of blood. The venom of poisonous snakes is secreted by modified salivary glands.

Recent studies by Japanese researchers indicate that a protein (q.v.) called parotin, extracted from the saliva of cows, acts as a catalyst to accelerate calcification of teeth and bones in young animals. Evidence also exists that salivary glands may produce proteins that regulate growth of embryos and newborn animals. The salivary glands, especially the parotid, of human beings are affected by the disease called mumps (q.v.).

SALK, Jonas Edward (1914–), American physician and epidemiologist, born in New York City, and educated at New York University and at the University of Michigan. He served as research associate at the school of public health



Dr. Jonas E. Salk administers the polio vaccine he developed, during preliminary tests in 1954.

National Foundation for Infantile Paralysis

of the University of Michigan from 1944 to 1946, when he was appointed assistant professor of epidemiology. In 1947 he became head of the virus research laboratory at the University of Pittsburgh, and was later research professor of bacteriology (1949–54), professor of preventive medicine and chairman of the department (1954–56), and professor of experimental medicine (1957–63). During this time Dr. Salk studied poliomyelitis and influenza (qq.v.) viruses, and he is most noted for development of an antipoliomyelitis vaccine, first distributed on a nationwide scale in 1955; see NATIONAL FOUNDATION—MARCH OF DIMES, THE. In 1956 he was awarded a Congressional Gold Medal for his work on the vaccine. In 1963 he became director of the Salk Institute for Biological Sciences, a research center in San Diego, Calif. In 1970 Salk married the French artist and writer Françoise Gilot (1925–), author of *My Life With Picasso* (1964).

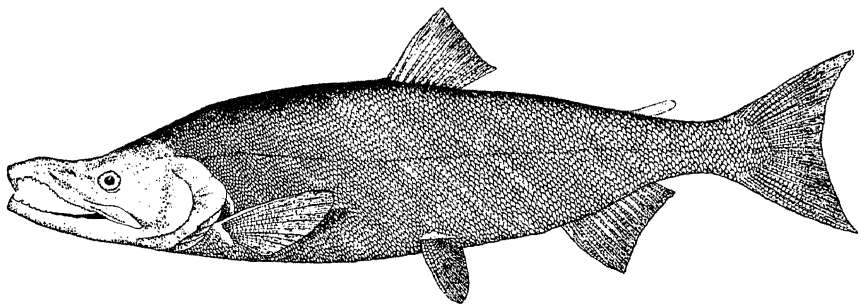
SALLUST, (Lat. *Gaius Sallustius Crispus*) (86–about 35 B.C.), Roman historian, born of a plebeian family in the town of Amiternum, 5 miles N. of the modern Italian city of Aquila. In 52 B.C. he was made a tribune of the people; see TRIBUNE: *People's Tribunes*. Sallust, who was opposed to

the Roman aristocratic party and its leader, Pompey the Great (see *under* POMPEIUS), was from the beginning a supporter of the rival Roman leader Gaius Julius Caesar (q.v.). He joined Caesar in the civil war of 49 to 45 B.C., serving as quaestor (q.v.) in 49 B.C.; see ROME, HISTORY OF: *The Republic*. As praetor (q.v.) in 46 B.C., he accompanied Caesar on his African campaign, and at its close he was made governor of the annexed kingdom of Numidia (q.v.). After his governorship, Sallust returned with an immense fortune to Rome, where he built the gardens near the Quirinal Hill that for centuries were known as the *Horti Sallustiani*. He subsequently retired to private life and devoted himself to the writing of history.

The two works by Sallust that still exist in their entirety are the *Bellum Catilinae* ("The Catiline War"), a vivid account of the conspiracy in 63 B.C. of the Roman political leader Lucius Sergius Catilina (q.v.), known as Catiline; and the *Bellum Jugurthinum* ("The Jugurthine War"), a history of the war fought (111–106 B.C.) between the Romans and Jugurtha (q.v.), King of Numidia. Sallust took as his model the Greek historian Thucydides (q.v.), seeking to explain the basic causes of the actions and events, and making his histories readable and dramatic. His works are colored by his disapproval of the weakness and immorality of the Roman state, which he expressed in his characteristic terse style.

SALMON, common name applied to a family of clupeiform fishes, and to seven species within that family. Members of the Salmon family, Salmonidae, are characterized by an elongate body, covered with small cycloid scales and possessing an adipose fin between the dorsal and anal fins. Most members of this family are valuable food fishes and excellent game fishes. They are found in both freshwater and salt water in the colder regions of the Northern Hemisphere; many of them migrate from salt water to freshwater to breed, and the young return to salt water from freshwater some time

Blueback or sockeye salmon, *Oncorhynchus nerka*



SALMON

after they reach maturity. The migratory instinct of members of the Salmon family is remarkably specific, each generation returning to spawn in exactly the same breeding places as the generation before it; even those species that do not migrate from freshwater to salt water spawn in the same freshwater streams as did their ancestors. The spawning ground of these fishes is usually a rapidly flowing, clear stream with gravel and rocks on the bottom. Although usually drab in color before the breeding season, which varies with the species, members of the Salmon family develop bright hues at spawning time; the male, during this season, usually develops a hooked snout and a humped back. Before mating, females excavate a nest for the eggs; after the eggs are deposited and fertilized, the female stirs up the stream bottom so that earth and stones cover the eggs and protect them. The eggs hatch in two weeks to six months, depending on the species and the temperature of the water. During the migrations and nest-building activity preceding mating, neither the females nor the males consume food. Members of the Salmon family subsist on smaller fishes, crustaceans, and insects. In addition to the true salmon, the Salmon family also contains many species known as char (q.v.); zoologists formerly included the grayling, smelt, and whitefish (q.v.), which are similar in structure, in the Salmon family.

Atlantic Salmon. The true salmon are the largest members of the Salmon family. These are characterized by tasty flesh that turns orange red when cooked. The common salmon of the North Atlantic Ocean is *Salmo salar* (most other fishes in the genus *Salmo* are called trout). Atlantic salmon sent to market average about 15 lb. in weight, but specimens weighing more than 100 lb. have been caught. The Atlantic salmon migrates to cold, fresh water in late spring or early summer, swimming upstream at an average rate of 2 to 4 mi. per day; because salmon are able to jump as much as 12 ft. out of water, they clear most obstacles in their path. The female lays as many as 20,000 eggs in October or November, after which time the adult salmon float downstream and return to the sea. Unlike the various species of Pacific salmon, which are discussed below, the Atlantic salmon does not die after its first spawning but returns year after year to its breeding place. The newly hatched young, which is known as a parr or a brandling because of the dark transverse markings on its sides, remains in freshwater for about two years; when two years old, the young, which is known as a smolt and which has be-

come silvery in color, descends to the sea. Upon the first return of the Atlantic salmon to its spawning ground the fish is known as a grilse. After spawning it is known as a kelt. Adult males traveling to the spawning grounds are commonly called dog salmon. Several subspecies of the Atlantic salmon live in the lakes of the northern United States without ever descending to sea; such salmon are known as landlocked salmon. Landlocked salmon are much smaller than migrating salmon, attaining a maximum weight of about 35 lb. The two most important landlocked subspecies of the Atlantic salmon are the Sebago salmon, *S. salar sebago*, found from New Hampshire to New Brunswick, and the ouananiche, *S. salar ouananiche*, of Lake Saint John, Canada.

Pacific Salmon. Salmon found in the North Pacific Ocean belong to the genus *Oncorhynchus*. These fishes spawn only once, dying after depositing and fertilizing their eggs. The best-known and most valuable species is the chinook, *O. tshawytscha*, which is also known as the king salmon, Columbia River salmon, Chinook, chowichee, and takou. Market specimens of this fish average about 20 lb. in weight, but numerous specimens over 5 ft. in length and well over 100 lb. in weight have been recorded. The king salmon migrates further than any other salmon, often traveling 1000 to 2000 mi. inland to its spawning ground. Its eggs usually hatch within two months, and the young descend to sea when 2 to 3 in. long. The sockeye, red, or blue-back salmon, *O. nerka*, is another valuable species, as is the coho or silver salmon, *O. kisutch*, which has light-pink flesh. Other salmon in this genus are the species commonly known as the pink or humpbacked salmon and the chum or dog salmon.

Anglers fish for salmon with rod and reel, usually using flies as bait. Commercial fishing for salmon is done on a much larger scale, employing traps and pound nets to catch the fish when on the way to their spawning grounds. Salmon canning is one of the major industries of the American Pacific coast. In order to preserve American salmon, the United States Fish and Wildlife Service yearly deposits billions of salmon eggs and young, propagated in nurseries, into natural breeding grounds. In addition, the Service constructs fish ladders to ease the upstream journey of mature salmon. The annual salmon catch in the U.S. averages more than 300,000,000 lb., of which about 60 percent is canned.

SALMONELLA, genus of infectious bacteria, named for the American veterinarian Daniel

Elmer Salmon (1850–1914) who first isolated it in 1885. The organism is transmitted through contaminated poultry, eggs, and certain other foods. Ten species of *Salmonella* have been identified, of which seven can affect humans. One species, *S. typhosa*, produces typhoid fever (q.v.). More common is *S. typhimurium*, which caused 17,000 reported cases of salmonella gastroenteritis, a type of food poisoning, in the United States in a recent year. *Salmonella* gastroenteritis has an incubation period of about eight hours, begins with biliousness, and is followed by fever, vomiting, and diarrhea. An attack may last from three to seven days. Mild cases usually are treated with antidiarrheal remedies; serious cases frequently require antibiotics. Careful cleaning and thorough cooking of food prevents salmonella infections. See also DISEASES OF ANIMALS: *Bacterial and Fungus Diseases*.

SALOME, two figures in the New Testament.

Salome (fl. 1st cent. A.D.), daughter of Herodias (14? B.C.—about 40 A.D.)—Herodias herself was the daughter of Herod Agrippa I—and of Herod Philip (d. 34), the son of Herod the Great (see under HEROD). Salome's dancing at the birthday banquet of her stepfather, Herod Antipas, Tetrarch of Galilee and Perea, induced the tetrarch to offer whatever she wished, up to half his domain. At the instigation of Herodias, who desired the death of John the Baptist (q.v.) because he had denounced her marriage to her first husband's half-brother, Salome demanded John's head. It was brought to her. Salome later married, first her uncle Philip the Tetrarch (d. 34), ruler of areas in what is now Syria, and second, Aristobulus (fl. 1st cent.), ruler of Lesser Armenia. The story of Salome, whose name does not appear in the New Testament, and of the death of John the Baptist is related in Matt. 14:6–11 and Mark 6:21–28. It forms the subject matter of a play, *Salomé*, by the Irish poet and playwright Oscar Wilde (q.v.); illustrations for that play by the British artist Aubrey Beardsley (q.v.); and the libretto of the opera *Salome*, based on Wilde's play, composed by the German Richard Strauss (q.v.).

Salome, wife of Zebedee and mother of the Apostles James the Greater (see under JAMES) and John the Evangelist (q.v.). She was present at the Crucifixion (Matt. 27:55–56, Mark 15:40) and was among the women who were first to learn of the Resurrection (Mark 16:1–6).

SALOME ALEXANDRA. See under MACCABEES.

SALOMON, Haym (1740–85), American financier and patriot, born in Lissa (now Leszno), Poland, of Portuguese-Jewish descent. He arrived

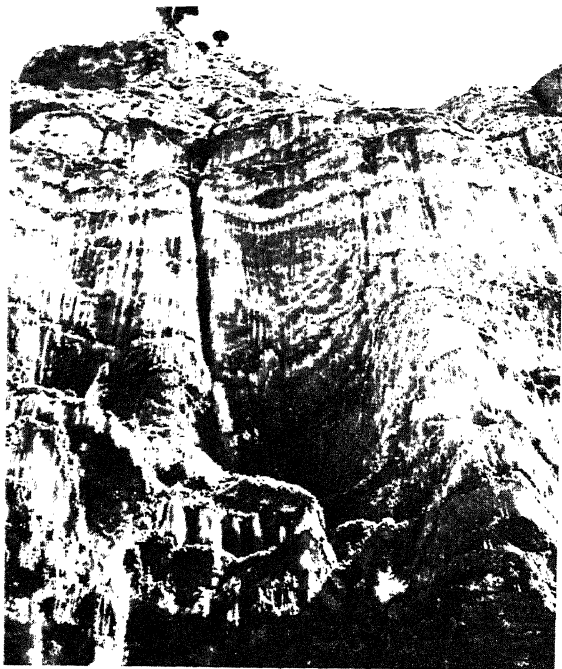
in America about 1772 and established himself in New York City as a merchant and broker. He associated himself with the cause of independence in the American Revolution (q.v.) and was twice imprisoned by the British. In 1778 he escaped to Philadelphia, where he became a successful broker and an agent of the American patriot Robert Morris (q.v.), the financier of the Revolution. Salomon helped to negotiate subsidies from foreign governments for the conduct of the war, and made substantial loans of his own money to the United States government. These loans were never repaid, and the question of suitable compensation to Salomon's descendants was brought before the United States Congress several times, but without results.

SALONIKA. See THESSALONIKI.

SALSETTE, island of the Republic of India, in the Arabian Sea, part of Maharashtra State, immediately N. of the city of Bombay, to which it is connected by causeway. Three artificial lakes in the center of the island supply Bombay with water. The principal crop is rice, and the largest towns are Bandra, Kurla, and Thana. The S. part of the island contains suburbs of Bombay. In the center of the island, at Kanheri, are more than a hundred Buddhist cave temples, which are excavated in the face of a single hill and contain elaborate carvings.

SALSIFY, or VEGETABLE OYSTER or OYSTER PLANT or GOATSBEARD, common name applied to a biennial herb, *Tragopogon porrifolius*, belonging to the Composite family, Compositae. Salsify, native to the Mediterranean region, was widely cultivated in Europe and America for its edible, spindle-shaped root, which, when cooked, has an oysterlike flavor. The root is white, about 8 to 12 in. long, and about 1 in. in diameter. Salsify is hardy and may be left in the ground during the winter. The roots are used in soups and stews, are prepared as creamed or mashed vegetables, or are cooked, mashed, shaped into cakes, and fried in deep fat like oysters. In the second year of growth, the salsify plant produces many-branched stalks, 3 to 4 ft. high, bearing terminal heads of purple flowers. Salsify is ready for consumption late in the fall. Black salsify is the term applied to *Scorzonera hispanica*, a European biennial herb in the same family as true salsify, and so called because its edible roots have a black outer covering. Black salsify is used for many of the same purposes as true salsify but is not as extensively cultivated.

SALT, acronym for Strategic Arms Limitation Talks between the United States and the Soviet Union which were held in Helsinki, Finland, and Vienna, Austria, in 1969 and continued into



Salt mountain at Barahona, Dominican Republic, the largest deposit in the world.

Dominican Republic Information Center

the early 1970's. See **DISARMAMENT: Agreements in Force.**

SALT, or **SODIUM CHLORIDE**, chemical compound of formula NaCl , m.p. 801°C . (1474°F .), b.p. 1413°C . (2575.4°F .), and sp.gr. of 2.16. It is a white solid, soluble in hot or cold water, slightly

soluble in alcohol (q.v.), but insoluble in concentrated hydrochloric acid (q.v.). In the crystalline form the compound is transparent and colorless, shining with an icelike luster. The compound usually includes traces of magnesium chloride, MgCl_2 , magnesium sulfate, MgSO_4 , calcium sulfate, CaSO_4 , potassium chloride, KCl , and magnesium bromide, MgBr_2 .

Salt is widely distributed in nature. It is found in solution in all ocean water in concentrations of about 0.2547 lb. per gallon of water. The compound is distributed also throughout many rivers and inland lakes and seas, the concentration varying from 0.002 percent in the Mississippi R. to 12 percent in the Great Salt Lake and 8 percent in the Dead Sea. Salt may occur in the form of a surface crust or layer in swamps and dry lake bottoms, especially in extremely arid regions. The mineral halite (q.v.), more commonly known as rock salt or massive salt, occurs in beds deposited by the dehydration of ancient bodies of salt water. The compound is constantly being formed by the action of rivers and streams on rocks containing chlorides and compounds of sodium (qq.v.).

History. Important to man as a seasoning and preserving agent since prehistoric times, salt was commonly used in the religious rites of the Greeks, Romans, Hebrews, and Christians. It was an important medium of exchange in the commercial ventures across the Mediterranean, Aegean, and Adriatic seas, and has been subject to severe taxation in Oriental countries from an-

After evaporation salt is gathered for export in Ceylon.
United Nations



cient to modern times. Because of its usefulness in preserving foods, salt was used by the ancient peoples as a symbol of enduring faith. In the form of salt cakes, it served as money in ancient Ethiopia and Tibet. The English term salary, which formerly represented a soldier's money allowance for salt, was derived from *salarium*, the Latin term referring to the salt allotment which was issued to soldiers of the ancient Roman army.

The simplest method of obtaining salt from areas near oceans or seas is by the evaporation of salt water, a process that is expensive and used only when cheaper methods are unavailable. In most regions, rock salt is obtained from subterranean sources by mining or by wells sunk to the deposits. In the latter method the salt is first dissolved in water forced down one of the well tubes, and the resulting brine is raised to the surface through other tubes. After being freed of clay impurities, the salt solution is evaporated. Gypsum (q.v.), if present, starts to precipitate first. This precipitation is removed by filtration, and thereafter further evaporation effects precipitation of salt and gypsum together. Several methods of evaporation are used in these processes, the most important of which are solar evaporation, in which the heat is derived from the rays of the sun; steam evaporation in vacuum pans and in covered kettles; and direct-heat evaporation in open kettles and in open pans. Most commercial salt is produced today by steam or direct-heat evaporation of rock-salt brine.

Uses. Salt has over a thousand uses. Most familiar is its use as a seasoning, and as such it is an essential constituent in the diet of human beings and other warm-blooded animals. Certain primitive tribes prohibit or restrict the eating of salt, but these peoples obtain necessary quantities of the substance from the salt-containing raw or cooked meat and fish that they habitually eat. Common table salt marketed for consumption in inland areas often has small quantities of iodides (see IODINE) added to prevent the occurrence of goiter (q.v.). Wild animals often congregate at salt streams or surface incrustations of salt, called salt licks, where they lick the incrustated salt. Industrially, salt is the source of chlorine (q.v.) and its principal compounds and the source of sodium and its compounds. Chlorine compounds of commercial importance include hydrochloric acid, chloroform (q.v.), carbon tetrachloride, and bleaching (q.v.) powder. Important sodium compounds are washing soda, sodium sulfate, baking soda, sodium phosphate, and sodium hydroxide. Salt

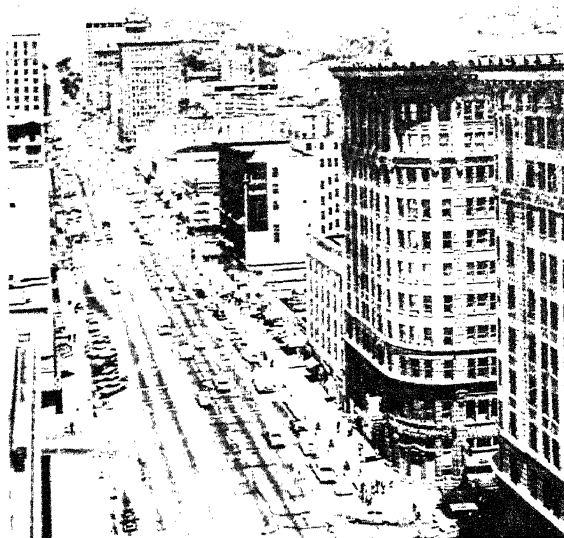
is widely used as a preservative for meats and is employed in some refrigeration processes, in dyeing, and in the manufacture of soap and glass. Because of its transparency to infrared radiation, salt crystals are used for making the prisms and lenses of instruments employed in the study of infrared radiation (q.v.).

SALTA, city in Argentina, and capital of Salta Province, near the Río Arenales in the irrigated Lerma valley, 780 miles N.W. of Buenos Aires. It is the commercial center of an area rich in oil and natural gas, and producing sugarcane, tobacco, grain, livestock, wine grapes, and timber. Industries include meat packing, tanning, sawmilling, sugar and flour milling, and the manufacture of leather goods and cement. The cathedral and numerous churches, government buildings, and private mansions reflect the Spanish colonial past. Today the city is of particular interest to tourists interested in colonial architecture. Two outstanding fiestas are held annually in September. The city was founded in 1582 as a stop on the road from the Bolivian silver mines. During the war of independence from Spain, Salta was the site where the Spanish were defeated by the Argentine general Manuel Belgrano (q.v.) in 1813. Pop. (greater city; 1970) 176,130.

SALTBUSH, common name applied to shrubby herbs of the genus *Atriplex*, particularly *Atriplex argentea*, belonging to the Goosefoot family, Chenopodiaceae. Members of the genus are cosmopolitan in distribution. They abound on alkali flats and afford good pasture with their succulent stems, foliage, and nutritive fruit. Garden orache, *A. hortensis*, is a type of saltbush. Greasewood, *Sarcobatus*, and creosote bush, *Larrea*, are sometimes also called saltbush.

SALTILLO, city in Mexico, and capital of Coahuila State, on a plateau of the Sierra Madre Occidental, 45 miles S.W. of Monterrey. The chief industries are the manufacture of cotton and woolen fabrics, ceramics, and flour. The Battle of Buena Vista, between Mexican and United States forces, was fought near the city in 1847 during the Mexican War (q.v.). Pop. (1970 prelim.) 191,800.

SALT LAKE CITY, city and capital of Utah, and county seat of Salt Lake Co., on the Jordan R., at the foot of the Wasatch Mts., about 37 miles N.W. of Provo. Great Salt Lake (q.v.) is 11 miles W. of the city. Salt Lake City is the principal commercial, manufacturing, financial, and distributing center of Utah. The chief agricultural products of the surrounding area, which is extensively irrigated, are sugar beets, cattle, fruits, poultry, and dairy products; the region is also



View of downtown Salt Lake City.

Salt Lake City Chamber of Commerce

rich in minerals, notably copper, silver, lead, and zinc. Among the industrial establishments in the city and vicinity are extensive meat-packing plants, canneries, oil refineries, smelting plants, steel mills, and factories for the production of electronic equipment and chemicals.

Educational and cultural institutions in Salt Lake City include the University of Utah (1850), Westminster College (1875), several museums and libraries, and the Utah Symphony Orchestra. In addition to the State Capitol, built in 1915, the most notable buildings in the city are those in Temple Square, religious center of the Mormon Church; see **MORMONS**. The famous Mormon Temple was begun in 1853 and completed in 1893 and has six spires rising to a height of 220 ft. The domed Tabernacle, completed in 1867, is an elliptical building seating 10,000 persons, and is noted for its remarkable acoustics. The Tabernacle Choir of 500 voices is famous throughout the United States. The site of the city was first settled in 1847 by a group of Mormons under the American religious leader Brigham Young (q.v.). The settlement was chartered as a city in 1851, and was known as Great Salt Lake City until 1868. It became the State capital when Utah was granted statehood in 1896; see **UTAH: History**. Pop. (1960) 189,454; (1970) 175,885.

SALTO, city in Uruguay, and capital of Salto Department, on the Uruguay R., 66 miles N. of Paysandú, opposite Concordia, Argentina. The third-largest city in the country and a road and rail hub, it lies in an area growing livestock, citrus fruit, sugarcane, grapes, and honey; it trades in grains and vegetables. Industries include

flour milling, meat packing, shipbuilding, and the manufacture of chemicals, drugs, and wickerwork. The city has a school of agriculture. Nearby are the resort of Arenitas Blancas and, 16 miles to the N., the river falls, the Salto Grande. The city is believed to have been founded in 1817, although claims have been made for earlier settlement. Pop. (1970 est.) 60,000.

SALTON SEA, lake of S.E. California in Riverside and Imperial counties, in the Salton Basin. It was formed between 1905 and 1906 when the Colorado R. broke through an embankment near Yuma, Ariz. and overflowed into California. The lake at first covered an area of about 450 sq.mi. and had a maximum depth of 67 ft., but its area has since decreased by at least one third through evaporation. The floor of the Salton Sea is about 280 ft. below sea level; it was originally a salt marsh and the water of the lake is saline.

SALTPETER or **NITER**, white, translucent, lustrous mineral composed of potassium nitrate, KNO_3 . It crystallizes (see **CRYSTAL**) in the orthorhombic system in prismatic crystals, which have a hardness (q.v.) of 2 and a specific gravity of 2.1, and which exhibit perfect domal cleavage. The mineral forms delicate crusts on the surfaces of rocks and stone walls, and occurs as a constituent of surface soil in Spain, Iran, the United Arab Republic, and India. In the United States it occurs in loose soil of the limestone caves of Kentucky, Tennessee, and the Mississippi valley. Saltpeter is of commercial importance in the manufacture of gunpowder (q.v.) and pyrotechnics (see **PYROTECHNY**), as a source of nitrogen in the manufacture of nitrogen-containing compounds, particularly nitric acid (q.v.), and as an oxidizing agent in many industrial chemical processes.

Chile saltpeter or soda niter is composed of sodium nitrate, NaNO_3 . It occurs over vast areas in South America, particularly in Chile, in beds which vary in thickness from 6 in. to 12 ft. The beds, called caliche, are interspersed with deposits of gypsum, sodium chloride and other salts, and sand. The caliche is quarried and purified in Chile before the Chile saltpeter is exported. In the U.S. small deposits are found in Nevada and California. Pure Chile saltpeter crystallizes in the rhombohedral system, forming white, semitransparent, lustrous crystals which are crystallographically similar to calcite (q.v.). It has a hardness ranging from 1.5 to 2 and a specific gravity of 2.24 to 2.29, and exhibits perfect rhombohedral cleavage. Chile saltpeter deliquesces; that is, it absorbs water from the atmosphere, becomes moist, and gradually dis-

solves. It is used extensively as a fertilizer and in the manufacture of nitric acid. It is not used in the manufacture of gunpowder because of its deliquescence, but it is used in making the less abundant saltpeter.

SALTS, in chemistry, large group of chemical compounds made by union of a metal or metallic radical with a nonmetal or nonmetallic radical, provided that the latter is not the hydroxide radical, OH. The commonest and most typical salt is sodium chloride, NaCl; see SALT. Many salts can be made by treating an oxide, an hydroxide, or, if it is active enough, a metal with the corresponding acid. Sodium chloride results, for example, from action of hydrochloric acid, HCl, on sodium hydroxide, NaOH. Metallic zinc and nitric acid give zinc nitrate, $Zn(NO_3)_2$, and copper oxide; CuO, and sulfuric acid, H_2SO_4 , produce the salt, copper sulfate, $CuSO_4$. The name of a salt records the elements or radicals composing it, the metallic part preceding. If only two elements comprise the salt, the name ends in *ide*. For example, the salt made of sodium and fluorine, NaF, is sodium fluoride. In the application of this rule, a metallic radical such as ammonium, NH_4 , is considered equivalent to a single element; thus ammonium chloride is NH_4Cl . Salts that contain more than two elements and are derived from acids the names of which end in *ic* (as sulfuric, nitric, and phosphoric acids) are designated by the suffix *ate*, as barium sulfate, $BaSO_4$, silver nitrate, $AgNO_3$, and sodium phosphate, Na_3PO_4 . Salts that contain more than two elements and are derived from acids the names of which end in *ous* (as sulfurous, nitrous, and phosphorous acids) are designated by the suffix *ite*, as sodium nitrite, $NaNO_2$. Salts, when brought to the liquid state by being melted or dissolved in water, are electrical conductors because in such state they separate into mobile ions; see ION. The metal part of the salt forms positive ions and the non-metallic part forms negative ions. Thus sodium chloride gives Na^+ and Cl^- ions. Although salts produce liquids that are fair electrical conductors, they are not nearly as good as metals in this respect.

Salts are classified as normal, acid, or basic. Normal salts contain neither hydrogen, H^+ , nor hydroxide, OH^- , ions. Acid salts, on the other hand, contain hydrogen ions and basic salts contain hydroxide ions. Potassium hydrogen sulfate, $KHSO_4$, is an example of an acid salt, and calcium hydroxychloride, $Ca(OH)Cl$, is an example of a basic salt. See ACIDS; BASES.

A vast number of salts, including those that occur naturally in the form of minerals and

those that are synthesized, have constant application in industry, science, medicine, agriculture, and the arts. Specific salts and their properties and uses are discussed in separate articles on the acids or metallic ions from which they are derived.

SALUKI, breed of hunting dog or hound for which there are records dating back to 3600 B.C. It is found living with desert tribes in the Middle East. The saluki is known to have been used to hunt the gazelle and is therefore sometimes called gazelle hound. The breed was introduced into England in the middle of the 19th century, and became popular in England and on the Continent toward the end of the century. The saluki which hunts chiefly by sight, is used in England to course hares. In recent years the dog has become popular in the United States as a show dog and a pet. The animal has a long, narrow head; bright eyes black or hazel in color; long ears covered with long, silky hair and lying close to the head; straight forelegs; hind legs set widely apart; and a long tail curving upward. The coat is smooth and silky, and is sometimes feathered on the legs, the back of the thighs and elsewhere on the body. The dog may be any of a number of colors, including white, fawn, golden, or red; or may be white, black, and tan, or black and tan. The average height of the male at the shoulder is from 23 to 28 in.; the female is usually smaller.

SALVADOR, formerly SÃO SALVADOR or BAHIA, city and port in Brazil, and capital of Bahia State, on a peninsula at the entrance to Todos os Santos Bay, 175 miles s.w. of Aracaju. Salvador is a major port, from which coffee, tobacco, sugar, cotton, industrial diamonds, and petroleum are exported. The principal industries of the city are shipyards, sugar refineries, cotton and flour mills, and tobacco factories. Salvador is built on a steep incline and is divided into the upper and lower towns, which are connected by elevators, cable cars, and winding roads. It is the site of the University of Bahia. The city was founded by the Portuguese in 1549 as São Salvador da Bahia de Todos os Santos. It was the capital of the Portuguese colonies in Brazil until 1763 and became capital of Bahia State in 1889. Pop. (1970 prelim.) 998,258.

SALVADOR, EL. See EL SALVADOR.

SALVAGE, in maritime law (q.v.), recovery of sunken or stranded vessels or their cargoes abandoned to destruction; see DERELICT. The term is also applied to the award, usually by a court of admiralty, to which voluntary salvors become entitled. Salvage may extend to rafts of logs washed out to sea, to derelict navigation



Uniformed Salvationists perform carols and solicit donations for the Salvation Army Christmas fund for the needy.

Salvation Army

beacons, to aircraft abandoned in navigable waters, to property such as money found on floating bodies, and to the recapture of ships taken by piracy or as prizes of war. A manned ship, although occupied by the captain alone, may refuse offers of salvage, but a derelict is available to the first salvor. Those who may claim salvage include crewmen who voluntarily return to a merchant ship after the master orders abandonment, as well as governments, which have the same rights as corporations and individuals. Crews on naval vessels become salvors only by government permission. Ships that damage each other cannot claim salvage for aid furnished thereafter. The salvor has a maritime lien on the property saved, but this claim may be reduced or forfeited if the salvor causes unnecessary damage. Although an owner may reclaim his property on paying salvage, he may elect to abandon it, allow the court to sell it, and recoup any amount remaining after the payment of salvage. The rules under which courts award salvage are complex, involving the value of ship and cargo, the value of the property saved, and the expenses of the salvor. The obligation of all seafarers towards saving lives cannot be rewarded but, lifesaving in conjunction with salvage of property may augment the amount of the award.

SALVATION ARMY, THE, international religious and charitable organization, founded in 1865 in London, England, by the British Methodist minister William Booth (q.v.). It is dedicated to the propagation of the Christian faith and to furnishing various forms of assistance to persons in need of spiritual solace and material aid. It was originally founded as the Christian Mission, with the aim of carrying on evangelical and social-welfare work among the inhabitants of the slum areas of London. The mission rapidly ex-

panded its activities; in 1878 it was reorganized along its present quasi-military lines and was renamed the Salvation Army. Booth was accorded the title of general, and the officers and members of the organization were given military ranks and titles in accordance with their duties. The army was later organized into territories, each of which had jurisdiction over a specified country or other major geographical area.

The international character of the Salvation Army dates from 1880, when a group of its members came to the United States and established an American branch in New York City. The movement subsequently spread to all parts of the world; in 1972, the Salvation Army operated in 70 countries, and the preaching of the Gospel was carried on by its members in more than 150 languages and dialects. In the same year the world membership of the organization totaled more than 1,000,000 persons, of whom more than 25,000 were officers who had graduated from the thirty-four schools maintained by the Salvation Army in many parts of the world. The facilities operated by the Salvationists throughout the world included 920 schools, 96 maternity homes, 160 children's homes, and 522 hotels, which in the course of one year gave free lodging more than 10,000,000 times and served almost 23,000,000 free meals. In the U.S., about 325,000 persons were enrolled in the Salvation Army. The institutions operated by Salvationists in the U.S. included 123 social service centers for men at which more than 70,000 homeless men were enrolled in 1972 in a program of work and rehabilitation; 55 camps that accommodated more than 53,000 children; 3 general hospitals; 35 maternity homes and hospitals; 14 children's homes and foster-care centers; 15 residences for young working women, and 16 centers for alcoholics.

The Salvation Army was particularly active during World Wars I and II, rendering a wide variety of services to Allied soldiers. In World War II, its American branch operated more than 3000 War Service Units, including 1000 mobile canteens, on 26 battlefronts. In the postwar period, the Salvation Army promulgated a program called Marching Forward, the main objectives of which included the promotion of evangelism; the prevention of juvenile delinquency; aid to veterans, servicemen, and their families; extension of services in police courts and prisons; and the rehabilitation of Salvation Army work in countries which had been devastated by war.

Salvation Army members preach in the open air, holding some 54,000 open-air meetings annually in the U.S. The doctrines of the Salvation Army are based on the teachings of the Bible and are considered fundamentally Christian; see FUNDAMENTALISM.

The activities of the Salvation Army are financed by voluntary contributions. Its social services are offered without discrimination as to race or creed. Its official publication is *The War Cry*. International headquarters is situated in London; U.S. headquarters, in New York City. **SALVIA.** See SAGE.

SALWEEN, river of China and Burma. In China, where it is also known as Lu Kiang, the river rises in Tibet Autonomous Region, and runs s. through Yunnan Province. After entering N.E.

Burma it flows generally s., and then forms part of the border between Burma and Thailand before emptying into the Gulf of Martaban at the port of Moulmein. The Salween R. is 1750 mi. long, but because of numerous rapids, it is only navigable for 74 mi. above its mouth.

SALZBURG, city in Austria, and capital of Salzburg Province, on the Salzach R., about 95 miles s.e. of Munich. Industries include tourism, the production of beer, and the manufacturing of metals, chemicals, and textiles. At Salzburg the Salzach R. passes between two lofty masses of rock, one of which, the Mönchsberg (1716 ft. high), bears an 11th-century fort. Known in Roman times as Juvavum, Salzburg has been an archbishopric since about 800; a 17th-century Renaissance cathedral is in the city. Salzburg was incorporated into Austria in 1814.

Salzburg was the birthplace and childhood home of the Austrian composer Wolfgang Amadeus Mozart (q.v.). It is a well-known resort, and the site of internationally famous annual music and drama festivals. Pop. (1971) 128,845.

SALZGITTER, city of West Germany, in Lower Saxony State, on a branch of the Weser-Elbe Canal, 16 miles s.w. of Brunswick. In an area producing iron and gas, the city produces coke and by-products, textiles, chemicals, machinery, metal products, canned foods, and refined beet sugar. In the city is the Solbad, a salt spring

View of Salzburg, looking toward the Mönchsberg.

Austrian Information Service



SALZKAMMERGUT

known since 800 and a spa since the 19th century; a 700-year-old city hall, now a hotel; and the Ringelheim castle and abbey. Named Watenstedt-Salzgitter when formed in 1942, the city is composed of twenty-nine former villages, including Salzgitter-Bad, with iron and potash mining; Watenstedt, with steel milling and smelting; Lebenstedt, with oil wells and potash mines; Lichtenberg, with potash mines; Gebhardshagen and Flachstockheim, with iron mines; and Thiede-Steterburg, a residential area. Pop. (1970) 119,000.

SALZKAMMERGUT, resort center in the Upper Austria and Styria provinces of Austria. Since prehistoric times salt has been mined in the immense deposits found nearby. In the lake region of the Alps it is famous for its scenery and archeological remains of early human habitation. The Dachstein (9829 ft.), a mountain covered with glaciers, is situated in the vicinity.

SAMAR, island of the Republic of the Philippines, constituting the province of Samar, separated on the N.W. from the island of Luzon by San Bernardino Strait, and on the S. from the island of Leyte by San Juanico Channel and Leyte Gulf. The area of the island is 5124 sq.mi. Agricultural products include hemp, rice, coconuts, and sweet potatoes. Catbalogan, on the W. coast, is the capital of the province. Area, 5050 sq.mi.; pop. (1970 est.) 1,217,000.

SAMARA. See KUYBYSHEV.

SAMARIA, ancient city and state in Palestine (q.v.). The city was located some 42 miles N. of present-day Jerusalem (q.v.) and about 25 miles E. of the Mediterranean Sea.

History. The city of Samaria was first built on a hill overlooking a main road to Jerusalem, the capital of King David (q.v.). It was chosen by Omri, King of Israel (r. 876–869 B.C.), who made it the capital of the northern kingdom; see ISRAEL, KINGDOM OF. The Assyrians conquered the region late in the 8th century B.C., as recorded in 2 Kings 17:1–6, 24; see also ASSYRIA.

After the Assyrian conquest the conquerors carried off many of the inhabitants, replacing some of them with people from other conquered lands. Nevertheless, the people of the region thereafter known as Samaria practiced a form of Judaism (q.v.) and preserved the so-called Samaritan Pentateuch (q.v.), which has retained an older text of the first five books of the Bible (q.v.) than is currently known in the Bible of the Jews.

When the Assyrian Empire itself was divided, Samaria passed to the Babylonians and then to the successive conquerors of Palestine. In Roman times the city was called Sebaste, and a

modern village nearby preserves that name in its own, Sebastiyeh or Sabastiya.

In Roman times, the Samaritans were considered heretical and hostile to the Jews, as is shown by the irony of the Tale of the Good Samaritan, who aided a sick Jewish traveler although members of his own faith would not (Luke 11:30–37), and by the story of the conversation between Jesus and the woman of Samaria (John 4:5–42).

On the ruined site of the ancient place, there still exist parts of a colonnade of the age of Herod, remains of a temple to Augustus, and other antiquities. A Harvard University expedition, from 1908 to 1911, made important discoveries on the site, and a new district, containing the remains of a large Roman water reservoir, was uncovered in 1931.

Modern Samaritans. In modern times a sect of Samaritans practices a religion similar to that of the Biblical Jews, with some admixture of Islam (q.v.). Their group numbers only about 200, living around their ancient temple site of Mt. Gerizim, near modern Nablus, Jordan, in an area occupied by Israel after 1967.

SAMARITAN LANGUAGE AND LITERATURE. The Samaritans produced a unique language and literature. Samaritan belongs to the Semitic languages and may be grouped with the western Aramaic dialects. It has not been popularly spoken since the 7th century, but it is still studied by a few priests in the small Samaritan community at Nablus, although the general speech there is now Arabic. The alphabet represents a comparatively slight modification of the Old Semitic in which the Phoenician and early Hebrew and Aramaic inscriptions were written, and differs from the square letters used in later Aramaic and Hebrew inscriptions and in Hebrew manuscripts. The literature is of small extent and is chiefly represented by the Samaritan Pentateuch and the Targum, the latter being a translation of the Hebrew text of the Pentateuch into the Samaritan Aramaic dialect.

See Jews: *The Kingdom*.

SAMARITAN PENTATEUCH, recension of the Hebrew text of the Pentateuch (q.v.), used by the Samaritans and written in a slightly modified form of the North Semitic alphabet employed by them. The first printed edition appeared in the Paris Polyglot Bible (1629–45). It was prepared by the French Roman Catholic theologian Jean Morin (1591–1659), who used a manuscript now in the Bibliothèque Nationale (q.v.). It was reprinted in the London Polyglot (1657). The British Hebrew scholar Benjamin Blayney (1728–1801) published an edition in the square

Hebrew characters (Oxford, 1790). See BIBLE; SAMARIA.

SAMARIUM, metallic element, one of the group of rare earths (q.v.), with at.no. 62, at.wt. 150.34, b.p. 1803° C. (3277.4° F.), m.p. 1072° C. (1961.6° F.), sp.gr. 7.4 to 7.54, and symbol Sm. It was discovered in 1879 by the French chemist Paul Émile Lecoq de Boisbaudran (1838–1912). Like other rare-earth metals, it is found in minerals such as cerite, gadolinite, and samarskite. It is thirty-ninth in order of abundance of the elements in the crust of the earth. The metal is hard, brittle, and lustrous; its yellowish-gray color tarnishes quickly in air. Samarium forms chiefly trivalent compounds; the salts are pale yellow in color. The metal and its compounds have no commercial use.

SAMARKAND, city of the Soviet Union, in the Uzbek S.S.R., in the valley of the Zeravshan R., about 130 miles S.E. of Bukhara. It is divided into a newly built section and an ancient section with buildings from the 14th and 15th centuries. Industries include the production of tea, wine, and food products, and the manufacture of leather goods, cotton and silk textiles, and clothing.

Samarkand, known by the ancient Greeks as Maracanda, was captured by Alexander III (q.v.), King of Macedonia, called the Great, in the 4th century B.C. It passed into Arabian hands in the 8th century A.D., becoming an Islamic center. It was almost completely destroyed by the Mongol ruler Genghis Khan (q.v.) in 1220. In the 14th century it became the capital of the kingdom of the Mongol conqueror Tamerlane (q.v.), whose tomb is in the old section of the city. In 1499 Samarkand was taken by the Uzbeks, and in 1784 it was conquered by the emirate of Bukhara. It passed to Russia in 1868. From 1925 to 1930 Samarkand was the capital of the Uzbek S.S.R. Pop. (1970) 267,000.

SAMBAR, or **SAMBUR**, common name applied to any of several large Asian deer, particularly to the Indian species, *Cervus unicolor*. The Indian sambar attains a height of over 5 ft. at the shoulders and may weigh as much as 600 lb. The coat is dark brown with chestnut marks on the rump and under parts. The large, rugged antlers are typically rusine, the brow tines being simple and the beams forked at the tip. In some specimens the antlers exceed 40 in. Sambars live in woodlands and feed mainly on grass and herbs. They are prized by hunters as sport trophies. See DEER.

SAMBRE, river of France and Belgium, about 120 mi. long, rising in Aisne Department, France. The river flows northeastward, and enters the

Meuse R. near Namur, Belgium. It is navigable for 100 mi. from Namur to Landrecies, France. The Oise-Sambre Canal connects Oise, France, with the Sambre R. at Landrecies.

SAMBUR. See **SAMBAR**.

SAMNITES, name of an ancient people who lived in Samnium, the mountainous center of southern Italy. They comprised the Caraceni, the Pentri, the Caudini, and the Hirpini. Because of their raids upon the people of Campania (q.v.), the latter placed themselves under the protection of Rome, and a series of wars took place between the Romans and the Samnites from 343 to 290 B.C. In the second war, from 326 to 304 B.C., the defeat of the Romans at the Caudine Forks in 321 B.C. very nearly gave to the Samnites the opportunity to be the rulers of Italy; they were forced by 304 B.C., however, to recognize the supremacy of Rome. The third war (298–290 B.C.) ended with the victory of Rome. The remaining Samnites joined unsuccessful attacks on Rome until 82 B.C., after which they were either Romanized or sold into slavery. See also **SABINES**.

SAMOA or **SAMOA ISLANDS**, formerly **NAVIGATORS ISLANDS**, group of islands in the Pacific Ocean, located about 2250 miles S.W. of Honolulu and about 1750 miles N.E. of New Zealand. The islands are situated between approximately lat. 13°25' S. and lat. 14°30' S. and long. 168° W. and long. 173° W. The islands E. of long. 171° W. form an unorganized territory of the United States named American Samoa. The islands W. of the meridian constitute the independent state of Western Samoa. The islands are volcanic or coral in origin. The large ones are mountainous and well forested. The climate is tropical, and rainfall is abundant from November to April. Earthquakes and severe hurricanes frequently occur. The islands are rich in vegetation, but the fauna is extremely limited. Snakes, lizards, and some birds are the only indigenous animals. Among the birds the most remarkable is a species of ground pigeon, the *Ducula strigirostris*, which is a link between the African *Treroninae* and the extinct dodo.

See separate article on **WESTERN SAMOA**.

SAMOA, AMERICAN, American islands that include Tutuila, on which a United States naval station is located; the Manua group, consisting of Tau, Olosega, and Ofu; Aunuu; Rose Island; and Swains Island. All except Rose Island, which is an uninhabited coral atoll, are of volcanic formation. Tutuila is the largest island of the American group, covering an area of about 53 sq.mi. and a population, including Aunuu, of 24,973 (1970). Pago Pago (q.v.), on Tutuila, is the seat of

SAMOA, AMERICAN

government of American Samoa and has one of the finest harbors in the South Pacific. It had a population (1970) of 24,511. The total area of American Samoa is 76 sq.mi.; the population (1970) was 27,159; the United Nations estimated (1969) 32,000.

Agriculture is the principal occupation. The most important crops include copra, taro, oranges, pineapples, bananas, papayas, breadfruit, yams, and coconuts. Canned fish and pet foods are processed and exported. Grass mats and other handicrafts are also made and exported. The economy of the territory is largely dependent upon grants and appropriations by the U.S. Congress. In the late 1960's revenue from local sources totaled about \$5,000,000, and grants and appropriations about \$9,400,000.

The People. Samoans are Polynesians, many of whom are converts to Christianity. Foreigners, including Americans, are prohibited by local laws from buying Samoan-owned land. Medical attention is provided by the government, which operates a general hospital and five dispensaries. A tropical disease medical center is being constructed. Regular shipping services connect American Samoa with the U.S., Fiji, Hawaii, Australia, New Zealand, and Japan. Several air lines serve American Samoa. Education is free and compulsory for all children between the ages of six and eighteen. In a recent year instruction was provided by about thirty public and three private schools, having an enrollment of about 9500 students and staffed by about 420 teachers, most of whom are Samoans. In twenty-one consolidated public elementary schools television is used for instruction.

Government. The islands are administered by the United States Department of the Interior. Under the constitution of 1966, executive authority lies with the governor, who is appointed by the secretary of the interior. Samoans are U.S. nationals, and the constitution contains most of the guarantees of the Bill of Rights. Legislative authority is vested in the Samoan legislature, or Fono, which consists of a Senate and House of Representatives. The Senate has eighteen members, who are elected from the local chiefs, and the House has twenty members, elected by popular vote. The islands are divided into three districts, each having a Samoan governor. Local administrative matters are conducted by village, county, and district councils composed of hereditary chiefs and their advisors. The judicial system includes a high court and five district courts. The secretary of the interior appoints the chief justice and an associate justice, who are assisted by four Samoan associate judges.

History. According to native tradition the Samoan Islands were the original home of the Polynesian race, from which colonists peopled the other Polynesian islands of the Pacific. Ethnologists, however, now believe that two separate waves of immigrants peopled Samoa, the first group probably originating in southwestern Asia. The later migration displaced the original Samoans, who then began to colonize the more easterly islands of Polynesia. The islands were discovered by Jacob Roggeveen, a Dutch navigator, in 1722. In 1768 Louis Antoine de Bougainville (q.v.), a French explorer, named the group the Navigators Islands. During the 19th century Germany, Great Britain, and the U.S. established commercial posts on the islands. In 1878 the U.S. annexed Pago Pago for use as a naval coaling station. In 1888 native disturbances resulting from the selection of a king created a crisis among the three powers. The matter was settled by the Act of Berlin in 1889, which proclaimed the independence and neutrality of the islands and guaranteed the natives full liberty in the election of their king. In 1899, during the course of a native civil war, the U.S. and Great Britain formed an alliance against Germany. Apia, site of the German station, was shelled by British and American ships. Agreement between the powers in regard to Samoa was, however, reached in the same year. Under the terms of the treaty of 1899 Germany received the islands west of long. 171° W., U.S. sovereignty was recognized over the islands east of the meridian, and Great Britain received the Solomon Islands and Tonga (qq.v.) as compensation. The chiefs of Tutuila and Aunuu ceded these islands to the U.S. in 1900. The islands of the Manua group were ceded in 1904. Swains Island was annexed by the U.S. in 1925 and added to American Samoa.

SAMOS, island of Greece, in the Aegean Sea, near the coast of Turkey, about 45 miles s.w. of İzmir. The island is mountainous, and the highest peak, Mt. Kerketëus (anc. *Cercetus*), reaches 4703 ft. Samos is about 27 mi. long and 12 mi. wide. Agricultural products include wine, tobacco, olive oil, and citrus fruit. The capital of the island is Limen Vatheos.

History. In ancient times Samos was very famous as a commercial and shipping center of the Aegean Sea. The island was celebrated also for its red, glossy pottery, which was imitated by the Romans in their so-called Samian ware. Subjected to Persian domination, in 499 B.C., Samos joined the Ionian revolt against Persia and following the battle of Mycale in 479 B.C., was once again independent. In the same year it became

a member of the Delian League (q.v.). When Samos revolted in 440 B.C. it was defeated and reduced to the position of a vassal of Athens. During the Peloponnesian War (431–404 B.C.) between Athens and Sparta, the island proved a faithful ally of the Athenian democracy, serving as the headquarters of the Athenian fleet, and in the later years of the struggle was restored its privileges. In 387 B.C. Samos passed into the possession of Persia but was eventually reconquered by the Athenians in 366 B.C. For almost twenty centuries the history of Samos is obscure. It is believed to have become part of the Roman Empire and subsequently a Byzantine possession. It was conquered by the Ottoman Turks in 1550 A.D. In 1832 it became semi-independent, the administration locally controlled but subject to the payment of a tribute to Turkey. Samos passed entirely to Greece as a result of the Balkan War of 1912–13.

Area, about 195 sq.mi.; pop. (1971) 114,802.

SAMOTHRÁKI or **SAMOTHRACE**, island of Greece, in the Aegean Sea, N.E. of the island of Limnos. It is about 8 mi. long and 6 mi. wide. The island, with an area of 71 sq.mi., is mountainous, rising to 5249 ft. at Mt. Fengári. From that point, according to the *Iliad*, an epic poem by the Greek poet Homer, Poseidon (qq.v.), the Greek mythological god of the sea, watched the battles around Troy. In ancient times Samothráki was a center for the religious cult of the Cabiri. The island was occupied by the Ottoman Turks from 1457 until taken by Greece in 1912. Samothráki is also the name of the main town of the island. Area, about 70 sq.mi.; pop. (1971) 3012.

SAMOYED or **SAMOYEDE**, breed of working dog with an ancient origin in western Siberia. The name is taken from the Samoyeds or Samoyedes, inhabitants of Siberia, with whom the dog has always been closely associated. It has

long been used by them for pulling sledges, herding reindeer, and as a watchdog. It was used in the 19th and 20th centuries by European and American arctic and antarctic explorers for pulling supply sledges. In recent times the Samoyed has become popular as a show dog in England and the United States. The dog has a powerful, wedge-shaped head with dark, alert, intelligent eyes set wide apart. The body is of medium length, with a broad and muscular back, straight legs, and a long tail. It has a thick, soft undercoat and an outer coat of long stiff hair; in color the dog is pure white, white and biscuit-colored, or cream. The male measures from 20 to 23 in. high at the shoulder and the female 18 to 21 in.; the male weighs from 45 to 55 lb. and the female 36 to 45 lb.

SAMOYEDS, or **NENTSI**, people inhabiting the extreme north of the Soviet Union between the Kanin and Taymir peninsulas. They live either in small tribal communities around the Ob' and Yenisey rivers or in scattered nomadic clans, the settled tribes generally subsisting by farming and the nomads by fishing, hunting, and trapping. Until recent times, all believed in and practiced Shamanism (q.v.). Their languages, known as Samoyedic or Samoyed, constitute one of the two subfamilies of Uralic, the other, and major, subfamily being the Finno-Ugric languages (qq.v.). Their place of origin is not definitely known; southwestern Siberia has been suggested by scholars as the most likely place. They appear to have reached northernmost Russia by the 12th century A.D., migrating there under pressure from other peoples moving into their original homeland. Recent estimates of their population range from 23,000 to 30,000.

M.P.

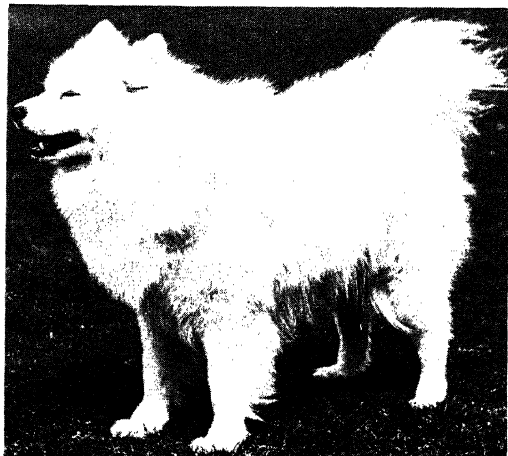
SAMPAN, common river and harbor skiff of the Far East, used for fishing, freight traffic, and as a crude houseboat. It is usually flat-bottomed, with a high-rake transom stern and a low pointed or transom bow, although hull shapes vary widely. Sampans may be propelled from the stern by either a large sweep or two short oars, and are sometimes rigged with a single lugsail. Shelter is provided by characteristic matted roofing that is arched or boxed to form a cabin over part or most of the deck. Sampans are found chiefly in China and Japan, but are also used in India and on numerous Pacific islands. See **FISHING VESSELS: Asian Types**; **JUNK**.

SAMPSON, William Thomas. See **SANTIAGO, BATTLE OF**.

SAMSON, in the Old Testament, Hebrew hero and for twenty years twelfth judge of ancient Israel, according to the story found in Judg. 13–16.

Samoyed dog

Walter Chandoha



SAMSUN

It is stated that he was the son of Manoah of Zorah, of the tribe of Dan (q.v.). Manoah's wife was barren, but an angel appeared to her and promised a son, who should be a Nazarite, that is, a consecrated person; see NAZARITES. No razor was to touch the boy's head, and it was through the supernatural strength with which his hair endowed him that Samson performed his great feats, including the strangling of a lion and the slaying of 1000 Philistines (q.v.) with the jawbone of an ass. Finally he was betrayed by a Philistine woman, Delilah (q.v.), who had his head shaved and who then handed him over to the Philistines. His eyes were put out, and he was forced to perform servile labor. His hair, however, grew again, and at a festival in honor of Dagon, the Philistine deity, Samson was exhibited as a public spectacle (Judg. 16:23–30). He pulled down the pillars of the house in which 3000 Philistines had assembled, consequently burying the multitude and himself in the ruins.

The story, set in the 11th century B.C., apparently underwent editorial revision. Its legendary or even mythical character seems obvious to many scholars. The meaning of Samson's name, "the sunny one", and the nature of some of his exploits suggest that Samson was originally a hero of the sun cult; see SUN WORSHIP.

Samson is recalled in the New Testament for his faith (Heb. 11:32–34). He is the subject of the tragic poem *Samson Agonistes* (1671), by the English poet John Milton (q.v.), and of the oratorio *Samson* (1743), by the German composer George Frederick Handel (q.v.).

SAMSUN, city and port in Turkey, and capital of Samsun Province, on the Black Sea, about 200 miles N.E. of Ankara. A resort city on the coastal railroad, it is an important tobacco port, and tobacco processing is the principal industry. The city is the trade center of an area producing grains, wool, hides, and vegetables. Founded by the Greeks in 562 B.C. as Amisus, or Amisos, on the site of a city destroyed by the Phrygians in 1182 B.C., it became an important city in Pontus after 300 B.C. Passing to Rome and Byzantium, it came under the rule of Genoa in the 14th century and was called Simisso. The city was taken by the Ottoman Turks in 1425. In 1869 Samsun suffered a disastrous fire. In 1919 the Turkish general and statesman Kemal Atatürk (q.v.) began his political conquest of Turkey at Samsun. Pop. (1970) 134,272.

SAMUEL, two books of the Old Testament (see BIBLE), in the King James Version, THE FIRST BOOK OF SAMUEL, OTHERWISE CALLED THE FIRST BOOK OF THE KINGS, and THE SECOND BOOK OF SAMUEL,

OTHERWISE CALLED THE SECOND BOOK OF THE KINGS. In modern Bibles, the two books of Samuel immediately precede the two books of the Kings (q.v.). The first to divide them into four books were scholars who made the early Greek version of the Old Testament known as the Septuagint. These scholars designated the four separated works as the first, second, third, and fourth books of the "Kingdoms". This fourfold division was followed in subsequent early Latin versions of the Old Testament, and eventually into modern times. The division of Samuel into two books did not appear in Hebrew Bibles until the middle of the 15th century A.D. In the Hebrew Bible, however, the first two of the books have long been named after the Hebrew judge Samuel (q.v.).

The books of Samuel relate the history of the Israelite people from the end of the period of the Judges (see JUDGES) to the last years of King David's life and reign; see DAVID; JEWS: *The Kingdom*. This relatively short period is a significant one in Jewish history, for it saw the establishment of the first Hebrew monarchy and the unification of the Israelite tribes into one kingdom with its capital at Jerusalem. The narrative may be divided into three main parts: events occurring in the period between Samuel's birth and Samuel's anointing of Saul (q.v.) to be the first Hebrew king (1 Sam. 1–7), events occurring in Saul's reign (1 Sam. 8–2 Sam. 1), and events occurring in David's reign (2 Sam. 2–24).

According to a Talmudic tradition (see TALMUD), Samuel was the principal author of 1 Samuel. As for the portion of that book relating events that occurred after Samuel's death, it was ascribed to the Hebrew seer Gad (q.v.) and the prophet Nathan. Modern scholars generally agree that the books are composite works, by several authors and author-editors from a number of different sources. Some suggest that the books were composed mainly from two sources, designated the Early Source and the Late Source. The Early Source is said to date probably from some time in the reign of Solomon (q.v.) and may have been composed by a single person. The Late Source is said to date from the century between 750 and 650 B.C. Other scholars suggest that three main sources, designated L, J, and E, were used. The earliest are believed to have been J and L (late 10th cent.); E is believed to date from the end of the 9th or the beginning of the 8th century B.C. The Early Source and the L and J sources favor the establishment, as divinely willed, of the monarchy. The Late Source and E, on the other hand, disapprove of the monarchy, condemning it as un-

necessary, a national rejection of the Lord, Who is the true king of Israel. Whatever their origin, however, the two books of Samuel have been long appreciated for their high value as history and literature.

SAMUEL (fl. 11th cent. B.C.), in the Old Testament, last of the judges, the first of the prophets (see PROPHECY), and next to the Hebrew prophet and lawgiver Moses and the patriarch Abraham (q.v.), the greatest personality in the early history of the Hebrew people (see JEWS: *The Hebrews in Canaan*). He became a temple attendant under Eli, the high priest at Shiloh (q.v.), and, according to one of two versions of his subsequent career found in 1 Sam. 7–16, summoned a national convocation to Mizpah (Tell en-Nasbeh, Israel), following twenty years of Philistine domination; see PHILISTINES. While the prophet and people were engaged in religious exercises the Philistines came upon them but were repulsed. The prophet thenceforward enjoyed a peaceful rule as judge over all Israel until, at another national convocation at Mizpah (10:17–27), Saul (q.v.), son of a Benjaminite (see BENJAMIN) landowner named Kish, was chosen first king of Israel. According to the other version of his life, Samuel's position was not as prominent as that of judge of all Israel. Saul is divinely made known to him as the instrument chosen by God to deliver Israel out of the hands of the Philistines. The seer secretly anoints the young Benjaminite and gives him certain signs. The accounts of Samuel's conduct in Saul's reign are also discrepant. Such discrepancies reflect differing attitudes toward the establishment of the Hebrew monarchy on the parts of the various authors whose works are combined in 1 and 2 Samuel (see books of SAMUEL).

SAMUELSON, Paul Anthony (1915–), American economist, born in Gary, Ind., and educated at the University of Chicago and Harvard University. In 1941 he joined the economics faculty of the Massachusetts Institute of Technology; in 1966 he was named institute professor, the highest professional rank at the institution.

A popular lecturer, columnist for the periodical *Newsweek*, consultant to such research organizations as the Rand Corporation and to the Federal Reserve Board, and adviser to Presidents John Fitzgerald Kennedy and Lyndon Baines Johnson, Samuelson is also the author of a best-selling economics textbook. Originally published in 1948, *Economics: An Introductory Analysis* has been translated into more than a dozen languages and by 1970 sold more than 3,000,000 copies. In this work Samuelson clearly and carefully expounds in mathematical and

quantitative terms his middle-of-the-road economic philosophy, based largely on the theories of the British economist John Maynard Keynes, 1st Baron of Tilton (q.v.). He uses mathematics to explain relationships among economic phenomena. For example, he has evolved formulas to relate gross national product (q.v.) to levels of employment and to analyze the balance between prices on the one hand and supply and demand on the other hand. For his contributions to economic theory, Samuelson was awarded the 1970 Alfred Nobel Memorial Prize in economics; see NOBEL PRIZES.

SAMURAI, warrior class in Japan, or a member of that class. Originally the term was applied to the whole military system of Japan, both nobles and vassals. By the beginning of the feudal period in the 12th century, however, it denoted the military retainers of a daimyo, who was a feudal baron under the shogun, or military governor, of Japan; see FEUDALISM. The samurai formed a distinct class, wearing two swords as a symbol of their caste and following a rigid code of ethics known as Bushido (q.v.). In 1867 the shogun resigned, and in 1871 the whole feudal system was abolished. The daimyos returned their lands to the emperor, both nobles and retainers were granted pensions, and the practice of wearing swords was prohibited. In 1878, the names daimyo and samurai were changed to kwazoku, or nobility, and shizoku, or gentry, respectively. See JAPAN: *History: Early Shoguns (12th–16th Centuries)*; *The Tokugawa Shogunate (1603–1867)*; *Restoration of Imperial Rule*.

SAN, ethnic group of Africa. See BUSHMEN.

SAN'A, or SANAA, city and capital of the Yemen Arab Republic, in San'a Province, on a plateau about 90 miles N.E. of the port of Hodeida. San'a is the commercial center of a fruit-growing region. The city is divided into two sections with the junction formed by the palace of the former imams, or rulers, of Yemen. The eastern section, or old city, has several mosques and a market area where such items as jewelry, silver and leather goods, silks, and carpets are manufactured and sold. The western section is residential. San'a first became an important center in the 4th century A.D., in the kingdom of an ancient Arabian people, the Himyarites (q.v.). It was later included in the Arab caliphate (see CALIPH), and was twice occupied by the Turks. Pop. (1970 est.) 120,000.

SAN ANDREAS FAULT, geological fault zone in California stretching northwest for about 600 mi., from the Imperial Valley in s. California to Point Arena on the coast; see FAULT; OCEAN AND OCEANOGRAPHY: *Ocean Basin Structure*.

SAN ANGELO

SAN ANGELO, city in Texas, and county seat of Tom Green Co., on the Concho R., about 180 miles n.w. of Austin. It is important chiefly as a shipping center for a sheep-raising and farming district. Industries in the city include oil refineries and food-processing plants. The site was first settled in 1867. The city is the site of Angelo State College (1928) and Goodfellow Air Force Base is situated nearby. San Angelo was incorporated as a city in 1889. Pop. (1970) 63,884.

SAN ANTONIO, city in Texas, and county seat of Bexar Co., one of the largest cities in the United States, 80 miles s.w. of Austin. The San Antonio R. and the San Pedro Creek unite within the city; the portion of the river that flows through the central business district is called the *Paseo del Río* (River Walk). Places of particular interest in San Antonio include the Alamo (q.v.); the HemisFair Plaza (92 acres), site of the 1968 San Antonio World's Fair; Brackenridge Park (320 acres), which houses the third-largest zoo in the U.S.; the Spanish Governor's Palace; the Cos House; the Navarro House; and the Mission Parkway, along which are the four Franciscan missions of Concepción, San José, San Juan Capistrano, and San Francisco de la Espada, all dating from the period 1720–50. Institutions of higher education include Saint Mary's University of San Antonio (1852; Roman Catholic); Trinity University (1869; Presbyterian); Incarnate Word College (1881) and Our Lady of the Lake College (1896), both Roman Catholic institutions for women; Oblate College of the Southwest (Roman Catholic; men); and San Antonio College (1925; junior). San Antonio is governed under the council-manager system.

Commerce and Industry. San Antonio is a leading banking center and a livestock, cotton, wool, and mohair market. Agricultural and livestock interests are predominant, and the wholesale houses of the city control the trade of

southwestern Texas and portions of northern Mexico. Manufacturing establishments include electronics, military support facilities, flour mills, brick and tile works, packing houses, oil refineries, machine shops, foundries, ironworks, and cement plants. Five major military installations are situated in and around the city: Fort Sam Houston, Randolph Air Force Base, Kelly Air Force Base, Lackland Air Force Base, and Brooks Air Force Base, home of the U.S. aerospace medicine program.

History. Although evidence exists that settlers occupied the site of San Antonio as early as 1715, the first permanent settlement within the limits of the modern city occurred in 1718 with the double founding of the mission of San Antonio de Valero, which later became known as the Alamo, and of the presidio of San Antonio de Bexar. These three colonizing elements—ranchmen, missionaries, and soldiers—were joined by a colony of 56 persons from the Canary Islands, and together they formed the first regular municipal organization in Texas, known as the villa of San Fernando de Bexar, which was raised to the status of a city in 1809. Three battles were fought here during the Gutiérrez-Magee expedition of 1813, which cost San Antonio nearly two thirds of its population. Under Mexican rule the affairs of the city were neglected, and it was left to its own devices. Slowly American settlers drifted in. In 1835 the Texan patriot army under Stephen Fuller Austin (q.v.) surrounded the city, and on Dec. 9 it capitulated. On March 6, 1836, occurred the storming of the Alamo (q.v.) by the Mexican General Antonio Lopez de Santa Anna (q.v.), whose troops massacred the entire garrison. After the decisive battle of San Jacinto (see SAN JACINTO, BATTLE OF), American pioneers pressed into the region, closely followed by Germans in the next decade. In 1861 the city was the scene of the



The Alamo, at the center of the old city of San Antonio.
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surrender of General David Emanuel Twiggs (1790–1862), of the Department of Texas, to the Committee of Safety appointed by the Secession Convention; see CIVIL WAR, THE AMERICAN. In 1878 the first railroad reached the city.

Population. Between 1910 and 1950 the population of San Antonio increased from 96,614 to 408,442. In 1960 the population was 587,718; in 1970 it was 654,153.

SAN BERNARDINO, city in California, and county seat of San Bernardino Co., at the foot of the San Bernardino Mts., about 60 miles E. of Los Angeles. It is the marketing center for a rich agricultural region, famous for its orange groves. Foodstuffs are processed in the city and industries include aircraft and rocket factories, foundries, and railroad machine shops. The city of San Bernardino was founded by a company of Mormons (q.v.) in 1851 on or near the site of a mission of the same name started by the Franciscans (q.v.) about 1820 and later abandoned. The city was incorporated in 1854. A campus of the California State College is in San Bernardino and Norton Air Force Base is situated nearby. Pop. (1960) 91,922; (1970) 104,251.

SAN BERNARDINO MOUNTAINS, range of the Coast Ranges, in San Bernardino and Riverside counties, Calif. The highest peak is Mt. San Gorgonio (11,502 ft.), about 27 miles E. of the city of San Bernardino. Most of the range is in the San Bernardino National Forest, with tourist resorts at Arrowhead and Big Bear lakes.

SAN BLAS. See CUNA.

SAN BRUNO, city of California, in San Mateo Co., on San Bruno Creek, 10 miles S. of downtown San Francisco. Local industries include printing and the manufacture of furniture and metal products; flowers, truck-farm products, and poultry are shipped. The city is the site of a branch of the College of San Mateo and of Junipero Serra County Park, the Tanforan Race Track, and Golden Gate National Cemetery. San Bruno was incorporated in 1914. Pop. (1960) 29,063; (1970) 36,254.

SAN BUENAVENTURA. See VENTURA.

SAN CARLOS, city of California, in San Mateo Co., on Pulgas Creek, 25 miles S.E. of San Francisco. The area grows and ships flowers, and the city manufactures electric and electronic equipment, metal products, building materials, industrial equipment and gases, ordnance, soap and detergents, and paint. Founded in 1887 on land originally a part of the Rancho de las Pulgas, the city was incorporated in 1925. Pop. (1960) 21,370; (1970) 25,924.

SAN CRISTÓBAL, city in Venezuela, and capital of Tachira State, about 100 miles S.W. of Mérida.

It is the marketing center of an agricultural region in the mountainous Cordillera de Mérida, where coffee, cotton, and cereal crops are produced. Industries in the city include textile mills, tanneries, cigarette factories, and distilleries. The city was founded in 1561. Pop. (1970 est.) 156,600.

SANCTI-SPÍRITUS, city of Cuba and capital of Sancti-Spíritus Province, on the Yayabo R., 240 miles S.E. of Havana. A road and rail center, it lies in an area growing sugarcane, tobacco, and livestock; gold, copper, and asphalt deposits are nearby. The city has sugar mills, tanneries, sawmills, and plants manufacturing tobacco products, pottery, and dairy products. It is connected by rail with the port of Tunas de Zaza, 20 miles to the S. A Spanish colonial city, it has a theater and churches of interest. Founded in 1514 at what at that time was believed to be the geographical center of the island of Cuba, the city was moved 2 mi. to its present site in 1533. Pop. (1970 prelim.) 57,703.

SANCTUARY, consecrated or sacred place, particularly one that gives refuge and inviolable asylum, or the protection afforded by entering such a place. In ancient Egypt the temples dedicated to Osiris and Amon (qq.v.) gave the right of sanctuary. The ancient Hebrews had cities of refuge open to those who had committed unpremeditated crimes. In ancient Greece all temples offered sanctuary. The right of sanctuary in Christian abbeys and churches was first recognized by law in the 4th century. It was frequently abused, however, and the right of sanctuary was abolished in England in 1623, ceasing to exist in most other countries by the end of the 18th century.

SAND, loose, incoherent mass of mineral materials in a finely granular condition, usually consisting of quartz (silica), with a small proportion of mica, feldspar, magnetite (qq.v.), and other resistant minerals. It is the product of the chemical and mechanical disintegration of rocks under the influences of weathering and abrasion; see EROSION. When freshly formed the particles are usually angular and sharply pointed, becoming smaller and more rounded by attrition when blown about by the wind or transported by water. Sand is an important constituent of most soils and is extremely abundant as a surface deposit along the courses of rivers, on the shores of lakes and the sea, and in arid regions; see SOILS AND SOIL MANAGEMENT. One specific form of sand is the major ingredient in glassmaking; see GLASS: *Glass Manufacture*. Other types of sand are used in foundries to make casting molds, in ceramics, plasters, and

SAND

cements. Sand is used as a grinding and polishing abrasive (q.v.) in the form of sandpaper, which is a sheet of paper covered on one side with sand or a similar abrasive substance. Sand-blasting is an important technique used in engraving (q.v.), cleaning, or cutting stone or glass, or for smoothing rough metal surfaces by blowing a stream of sand under air or steam pressure.

SAND, George, pen name of AMANDINE AURORE LUCIE DUPIN, BARONNE DUDEVANT (1804–76). French novelist, born in Paris. She was the daughter of Maurice Dupin (d. 1808), a French army officer, who was descended from Augustus II, King of Poland (1670–1733). Most of her childhood was spent at Nohant-Vic, in the former province of Berry (now in Indre). Her career as a novelist did not begin until 1831, when she moved to Paris, where she joined a group of distinguished artists that included the French novelist Honoré de Balzac and the Hungarian pianist and composer Franz von Liszt. She also became celebrated for her liaisons, particularly those with the French poet Alfred de Musset and the Polish composer Frédéric François Chopin (qq.v.).

George Sand was a prolific writer, expressing in her works a deep concern for human problems and strong feminist ideals. She wrote her first two novels in collaboration with the French novelist Jules Sandeau (1811–83). They were published under the name Jules Sand, which suggested the pen name she adopted for her

next work, *Indiana* (1832). Her writings generally are divided into four periods. The novels of the first period (1832–36) were idealistic and romantic, typical examples being *Valentine* (1832) and *Lélia* (1833). The second period (1840–48) was devoted to such novels as *Consuelo* (1842), in which she expounded socialistic and humanitarian ideals. After the Revolution of 1848 she retired permanently to her country house at Nohant-Vic, where she wrote the novels of her third period (1848–60), concerned with country life, including *La Petite Fadette* ("Little Fadette", 1849). Her last novels, which returned to wider social considerations and were judged among her best, include *Le Marquis de Villemer* (1861) and *Mlle. la Quintinie* (1863). Although her novels were widely read in her time and were a strong influence on young writers, they gradually lost favor and are read today mainly as curiosities.

See FRENCH LITERATURE: *The Romantic Movement*.

SANDAGE, Alan Rex (1926–), American astronomer, born in Iowa City, Iowa, and educated at the University of Illinois and the California Institute of Technology. He became an astronomer at the Mount Wilson and Palomar observatories in 1952. With the use of the 200-in. Palomar telescope, Sandage produced the first spectrographic image of quasars (q.v.), the so-called blue stars billions of light-years from the earth. Sandage was also a pioneer in radio astronomy (q.v.). His work is especially important for cosmologists in testing their theories concerning the origin of the universe.

SANDAL. See BOOTS AND SHOES.

SANDALWOOD, compact, fine-grained, costly wood of several species of the genus *Santalum* of the family Santalaceae, natives of southeast Asia and the South Pacific. It is used for making small ornamental articles and cabinets and is remarkable for its fragrance, due to an essential oil that repels insects.

White sandalwood, the most common kind, is derived from a small tree, *S. album*, a native of mountains in southern India and the Indian Archipelago. It is much branched and resembles myrtle in its foliage and privet (qq.v.) in its flowers. The tree is seldom more than 30 ft. in height and 1 ft. in diameter. A kind sometimes called yellow sandalwood is produced by *S. freycinetianum* of the Indian Archipelago and Hawaii. The species *S. yasi* yields the much-valued sandalwood of the Fiji Islands. Sandalwood, however, has almost disappeared from Hawaii, Fiji Islands, and elsewhere in consequence of the demand for its wood in commerce.

George Sand

Bettmann Archive



Red sandalwood, or sanders, is the product of *Pterocarpus santalinus*, of the Legume family, Leguminosae, native to tropical Asia, particularly of the mountains in southern India and Ceylon. The dark-red, black-veined heartwood, which sinks in water, is used as a dyestuff and to color certain preparations of druggists. It is also the basis of some tooth powders. The wood of *Adenanthera pavonia*, a relative of the acacia (q.v.), is sometimes called red sandalwood or redwood.

Sandalwood oil is antiseptic and stimulating, especially on the genito-urinary tract, and is used medicinally in gonorrhea and chronic bronchitis (qq.v.), being particularly valuable in the former disease.

SANDALWOOD ISLAND. See SUMBA ISLAND.
SANDBLASTING. See SAND.

SANDBUR, or BUR GRASS, any of various annual or perennial weedy plants chiefly of the genus *Cenchrus* in the Grass family, Gramineae, having prickly burlike fruits; see WEEDS. Sandburs are found in sandy soil in temperate and tropical regions of the world. They have long slender leaves and minute flowers and grow as high as 3 ft.; the burs are painful to flesh. The weeds are eaten as forage by animals but are dangerous to them when the burs have ripened; see GRASSES: Uses. Two of the best known species of sandbur in the United States are *C. longispinus* and *C. tribuloides*, both of which are found along shorelines and river banks.

Other genera growing in deserts are sometimes known as bur grass. One of these, the buffalo bur or buffalo grass, *Solanum rostratum*, is native to the American plains and river valleys; see NIGHTSHADE. Another species, the bur-ragweed, *Franseria dumosa*, is found in western deserts. See NETTLE.

SANDBURG, Carl (1878–1967), American poet and biographer, born in Galesburg, Ill. He served in the Spanish-American War (q.v.) before returning to Galesburg to attend Lombard College. From 1910 to 1912 he was secretary to the mayor of Milwaukee, Wis., and in 1913 he moved to Chicago.

Although Sandburg's earliest poetry was published in 1904, he first gained recognition when the poem "Chicago", which appeared in the magazine *Poetry* in 1914, was awarded the Levinson Prize. The collection *Chicago Poems* (1915), in which he used unrhymed free verse and the techniques of imagism (q.v.), established his reputation as a realist concerned with industrial themes.

Sandburg served on the staff of the *Chicago Daily News* as an editorial writer from 1918 to



Carl Sandburg

Harcourt Brace & Jovanovich, Inc.

1933. During that period he wrote such volumes of poetry as *Cornhuskers* (1918), *Smoke and Steel* (1920), and *Good Morning, America* (1928), all of which express a basic optimism for the future of America. His poetry gained wide appreciation for its impressionistic style and colloquial vigor.

Sandburg's fame as an historian rests on his monumental works *Abraham Lincoln: The Prairie Years* (2 vol., 1928) and *Abraham Lincoln: The War Years* (4 vol., 1939; Pulitzer Prize, 1940). Sandburg felt that previous biographies of Lincoln had tended to idealize him to the point of unreality. His own history is considered a masterly interpretation of all available material on Lincoln. A children's version of the first part appeared as *Abe Lincoln Grows Up* (1928).

Sandburg was widely known also as a singer of American folk songs, many of which he collected in *The American Songbag* (1927). Among his other works is the novel *Remembrance Rock* (1948), *Complete Poems* (1950; Pulitzer Prize, 1951), and the autobiography *Always the Young Strangers* (1952). A member of the American Academy of Arts and Letters, he received its gold medal award for history in 1952 and for poetry in 1953. He was awarded the United States Presidential Medal of Freedom in 1964.

SAND DOLLAR, common name applied to any of several sea urchins having a flat, circular outer shell, belonging to the order Clypeastroidea. The common sand dollar of the northeast-

SANDERLING

ern United States, *Echinarachnius parma*, is found on sandy bottoms in comparatively shallow water. The shell is about 3 in. in diameter and has many small perforations that form a symmetrical petallike design. The entire shell is penetrated by many small, brown spines that give the shell a velvety appearance and enable the animal to move about. Sand dollars obtain food by engulfing sand from which they extract minute plants and animals. See ECHINOIDEA.

SANDERLING, common name applied to a small sandpiper (q.v.), *Crocethia alba*, almost worldwide in distribution. The bird breeds in the Arctic Region and migrates to southern coastal regions. It is distinguished from other true sandpipers by the lack of a well-developed hind toe. Male and female adults are about 8 in. long. In the fall they are the palest of the sandpipers, with grayish-white upper parts and white under parts. The spring plumage is brightened by red spots tinged with black. Sanderlings feed on small crustaceans and worms.

SAND FLEA, or BEACH FLEA, amphipod crustacean; see CRUSTACEA. Sand fleas are so abundant on sandy shores that often the whole surface of the sand seems to be alive with the multitudes that, leaping up for a few inches into the air, fill it like a swarm of dancing flies. They may also be found burrowed in the sand. Sand fleas leap by bending the body together and throwing it open with a sudden jerk. They feed on almost any dead or decaying vegetable or animal substance.

SAND FLY, common name applied to any minute, biting, dipterous fly of the genera *Culicoides* and *Phlebotomus*. For a discussion of sand flies in *Culicoides*, see MIDGE. Sand flies of *Phlebotomus*, also known as moth flies, are important as the vectors of numerous human diseases, including kala azar or dumdum fever, oriental sore, and sand-fly fever. These moth flies, which belong to the family Psychodidae, are chiefly native to the tropical and subtropical regions of the world. They are somewhat smaller than $\frac{1}{8}$ in. in length. Female sand flies are equipped with piercing mouthparts and subsist on mammalian blood. Sand flies are weak fliers and bite mostly at night. They breed in dark, damp, mossy ground or in crevices in shady rock walls. Six species are found in the United States, none of which are known to carry disease. The most famous species of sand fly is *P. papatasi*, which transmits the virus of a febrile disease known as sand-fly fever or phlebotomus fever, and which is somewhat similar in symptoms to dengue (q.v.). Although almost never fatal, sand-fly fever disables its victims for

from one to nine days. Sand-fly fever occurs chiefly in Asia Minor, southern Asia, northern Africa, and southern Europe. Having once ingested blood contaminated with the virus of sandfly fever, *P. papatasi* carries the virus for the rest of its life; many scientists believe the female sand fly passes the virus on to its young.

SANDHURST, Great Britain, village of Berkshire, England, near which is the Royal Military Academy. Established in 1799, the school was not officially founded as the Royal Military College until 1802. In 1812 the college was moved from Great Marlow, Buckinghamshire, to Sandhurst. The school received its present name in 1947, when it was amalgamated with the Royal Military Academy that was formerly at Woolwich, London. Cadets usually enter the academy after passing an examination and serving for a short period in the regular army. The courses cover science, mathematics, languages, and military training, and the period of attendance is usually from eighteen to twenty-one months. See EDUCATION, MILITARY.

SAN DIEGO, city in California, and county seat of San Diego Co., on San Diego Bay, 125 miles S.E. of Los Angeles. The location and mild, equable climate of the city make it a year-round vacation resort as well as a vigorous research, manufacturing, and trading center. Transportation facilities include San Diego International Airport (Lindbergh Field), modern municipal airports, and two major railroad systems. The harbor facilities can handle more than 1,000,000 tons of goods annually.

The nine institutions of higher education in the city include the San Diego campus of the University of California, United States International University, San Diego State University (q.v.), the University of San Diego (1949; Roman Catholic), and California Western University (1924; Methodist). Cultural facilities include the 3000-seat Civic Theater; the Old Globe Theater, home of the National Shakespeare Festival; the San Diego Symphony Association; and the San Diego Opera Guild. The city is governed under the council-manager system.

The extensive park system of San Diego includes Balboa Park (1400 acres), the San Diego Zoo, Sea World (50 acres), the largest oceanarium in the world, and some 70 mi. of beaches, coves, and waterways. Mission Bay and Shelter and Coronado islands in San Diego Bay offer extensive sport facilities. Points of interest include Cabrillo National Monument (q.v.); Fort Stockton; four Spanish missions, including San Diego de Alcalá, the oldest mission in California; and the *Star of India*, oldest iron sailing vessel afloat.

Commerce and Industry. The principal industries of San Diego are aerospace, shipbuilding, electronics, tuna and other food processing, printing and publishing, the manufacture of clothing and chemicals, and industries related to the sea, such as the production of fishing, sporting, and scientific equipment. Agricultural production of dairy products, livestock, fruits, and nuts totals more than \$100,000,000 annually. The city is headquarters for the Eleventh Naval District, the largest in the United States, and four nationally famous research institutions: the U.S. Navy Electronics Laboratory, Scripps Institute of Oceanography (see SCRIPPS, EDWARD WYLLIS), Salk Institute of Biological Studies, and Palomar Observatory (q.v.).

History. San Diego Bay was discovered in 1492 by Juan Rodriguez Cabrillo (q.v.), who claimed the area for Spain. Don Sebastian Vizcaino (1550?-1615), the second European to set foot on California soil, established camp at Ballast Point on the bay in 1602. In 1769 the Franciscan priest Juníperro Serra (q.v.) established the Mission San Diego de Alcalá, and in 1825 San Diego became the capital of California under the flag of Mexico. In 1846 General Stephen Watts Kearny (q.v.), under the command of Commodore Robert Field Stockton (1795-1866), took possession of the area for the U.S. Incorporated as a city in 1850, San Diego was a prominent whaling center between 1850 and 1870. Expositions were held in the city in 1915-16 and 1936.

Population. Between 1910 and 1950 the population of San Diego increased from 39,578 to 334,387. In 1960 the population was 573,224; in 1970 it was 696,769.

SAN DIEGO STATE UNIVERSITY, State-supported coeducational institution of higher learning, situated in San Diego, Calif., and

founded as a normal school in 1898. The name of the school was changed in 1935 to San Diego State College, and the present name was adopted in 1972. Baccalaureate degrees are conferred in applied arts and sciences, liberal arts, business administration, education, and engineering. The degree of master is conferred in the arts and sciences, business administration, and social work. Doctoral degrees in chemistry, ecology, and genetics are awarded jointly with the University of California. In 1973 the library housed more than 500,000 bound volumes, student enrollment totaled about 30,000, and the faculty numbered 1700.

SANDPAPER. See SAND.

SANDPIPER, common name applied to a family, Scolopacidae, of charadriiform shore birds, and to several species within that family. The Sandpiper family, which contains about eighty-two species, is chiefly native to the cold regions of the Northern Hemisphere; its members migrate into more temperate regions in the fall. Most scolopacids inhabit seashores; some species are found on inland ponds, lakes, and rivers. Scolopacids are small birds, many of which are under a foot in length, and are characterized by long bills which are sometimes soft at the tip, by long legs, short tails, long, flat, pointed wings, and possession of a hind toe in all species but the sanderling (*Crocethia alba*). They are generally dull colored, the upper parts being blotched with black, brown, and gray, and the lower parts usually being lighter. Ordinarily, birds in this family move about together in flocks, but during the nesting season they travel only in pairs. Many species have elaborate courtship ceremonies during which the male struts about and dances before the female; in some species, the song of the male is as attrac-

Red-backed sandpiper,
Arquatella maritima

Gordon S. Smith -
National Audubon Society



SANDROCOTTUS

tive as that of many oscine birds; see BIRD: *Habits: Song*. The birds nest in shallow holes in the ground, the female depositing three or four varicolored eggs in a clutch. Scolopacids usually subsist on insects, minute shellfish, and other small animal life which they obtain by probing in the sand or mud with their long bills. In addition to the birds commonly known as sandpipers, the Sandpiper family includes the curlew, knot, sanderling, snipes, tattlers, woodcock, yellowlegs, dunlin, godwits, ruff, and willet.

Of the sandpipers proper, the scolopacids most commonly seen inland are the common sandpiper, *Actitis hypoleucos*, in Europe, and the spotted sandpiper, *A. macularia*, in the United States. The spotted sandpiper, which is also known as the teetertail, averages about $7\frac{1}{2}$ in. in length. It habitually bobs its head and tail when walking or at rest. A less common, American, inland sandpiper is the solitary sandpiper, *Tringa solitaria*, which averages about $7\frac{1}{2}$ in. in length. The bird is commonly found on muddy shoals along wooded ponds.

Of the seagoing sandpipers, the least sandpiper, *Erolia minutilla*, is one of the most common on both American coasts. This bird, which has yellowish legs, is the smallest of the sandpipers, averaging less than 6 in. in length. The semipalmated sandpiper, *Ereunetes pusillus*, which is about $\frac{1}{2}$ in. longer than the least sandpiper, is found along the American Atlantic coast but also occurs very commonly in freshwater areas well inland. This bird derives its common name from the partial webbing of its toes, most other scolopacids having completely webbed toes. The purple sandpiper, *Erolia maritima*, of the northeastern U.S., averages about 8 in. in length. Compare PLOVER.

SANDROCOTTUS. See CHANDRAGUPTA.

SANDSTONE, coarse-grained, sedimentary rock consisting of consolidated masses of sand (q.v.). The chemical constitution of sandstone is the same as that of sand; the rock is thus composed essentially of quartz (q.v.). The cementing material which binds together the grains of sand is usually composed of silica, calcium carbonate, or iron oxide. The color of the rock is often determined largely by the cementing material, iron oxides causing a red or reddish-brown sandstone, and the other materials producing white, yellowish, or grayish sandstone. When sandstone breaks, the cement is fractured and the individual grains remain whole, thus giving the surfaces a granular appearance. Sandstones of various geologic ages and of commercial importance are widely distributed in the United States. The rock is used extensively in

building flagstone pavings and in the manufacture of whetstones and grindstones. See GEOLOGY: *Petrology*.

SANDUSKY, city and port of entry in Ohio, and county seat of Erie Co., on Sandusky Bay, an arm of Lake Erie, about 50 miles w. of Cleveland. The city has a spacious harbor and is a major shipping point for coal and limestone. Sandusky is also an important manufacturing center for such products as electrical appliances, machinery, pleasure boats, paper goods, and artists' materials. Large commercial fish hatcheries are maintained near the city. Sandusky is on the site of a British fort that was built in 1761 and burned in 1763 during an uprising under the American Indian chief Pontiac (q.v.). A permanent settlement, known as Portland, was founded in 1817 and incorporated as a city in 1824. The name of the city was changed in 1844. Pop. (1960) 31,989; (1970) 32,674.

SANDWICH ISLANDS. See HAWAII: *History*.

SANDY HOOK, peninsula of New Jersey in Monmouth Co., about 15 miles s. of Manhattan. The peninsula separates Sandy Hook Bay from the Atlantic Ocean and is part of the Gateway National Recreation Area, authorized by the United States Congress in 1972. Fort Hancock, on the n. tip, was originally designed as a coast artillery station for the protection of New York Harbor; it is used today as an artillery testing ground. Sandy Hook Lighthouse was built in 1783.

SAN FERNANDO, city of California, in Los Angeles Co., about 20 miles n.w. of central Los Angeles. Manufactures include clothing and electronic equipment. Nearby is the San Fernando Mission, which dates from 1797. Pop. (1960) 16,093; (1970) 16,571.

SAN FERNANDO, city in Trinidad and Tobago, on the island of Trinidad, on the Gulf of Paria, 27 miles s. of Port-of-Spain. The second-largest city in Trinidad, it is a rail and road hub. It lies in an area of sugar estates and mills, sawmills, and oil fields and exports their products. One of the world's largest oil-refining and petrochemical centers is at Pointe-à-Pierre, nearby. San Fernando is the site of a teacher-training college. Developed on a Spanish land grant of 1786, the city was chartered in 1846. Pop. (1970) 32,500.

SANFORD, city in Florida, and county seat of Seminole Co., on Lake Monroe, about 20 miles n.e. of Orlando. The city is a chief marketing area for celery, and also ships citrus fruit. Sanford manufactures clothing and concrete products. It is the site of Seminole Junior College, established in 1965. Pop. (1960) 19,175; (1970) 17,393.

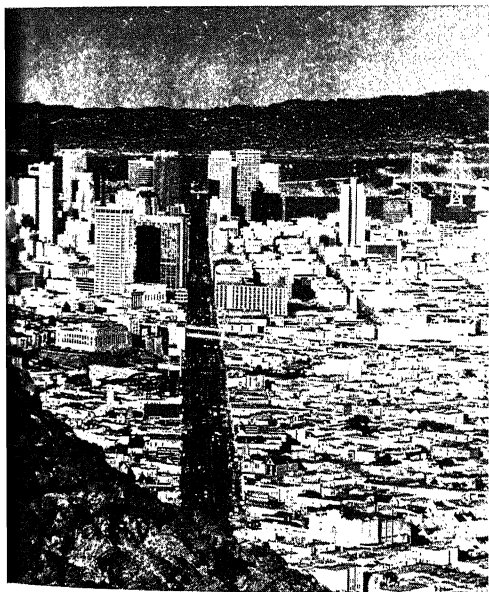
SAN FRANCISCO, city in California, coextensive with San Francisco Co., on a peninsula bounded on the w. by the Pacific Ocean, on the n. by the Golden Gate, and on the e. by San Francisco Bay, about 340 miles N.W. of Los Angeles. San Francisco Bay (q.v.) provides the city with one of the finest landlocked harbors in the world and is connected with the Pacific Ocean by the Golden Gate (q.v.) strait. Among the islands in San Francisco Bay are Yerba Buena Island, site of a United States Navy installation; Angel Island, site of Fort McDowell, a United States Army post; Treasure Island, an artificial island of 400 acres constructed for the Golden Gate International Exposition (1939-40) and now a U.S. Navy and air base; and Alcatraz (q.v.), former site of a Federal prison. Mare Island, containing a U.S. Navy Yard, is in San Pablo Bay, an arm of San Francisco Bay.

San Francisco Bay is spanned by eight major highway bridges and two railroad bridges. The Transbay Bridge, or San Francisco-Oakland Bay Bridge, which opened in 1936, is one of the longest combination bridges in the world. The Golden Gate Bridge (1937), with a central channel span of 4200 ft., is the second longest suspension bridge in the world. The Richmond-San Rafael Bridge (1956) and the Carquinez Strait Bridge are cantilever bridges.

Harbor facilities of San Francisco include about fifty piers and more than 15 mi. of berth-

San Francisco seen from Twin Peaks, with Market Street in the center and the Transbay Bridge at top right.

San Francisco Convention and Visitors Bureau



Grant Avenue, the main street of the Chinatown district of San Francisco.

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ing space. The city is served by the San Francisco International Airport, major transcontinental railroads, and numerous steamship lines, in addition to truck lines and transcontinental bus lines.

The highly automated, 75-mi.-long Bay Area Rapid Transit system (BART), serving East and West Bay communities, was completed in 1974.

Places of Interest to Visit in San Francisco.

San Francisco, comprising an area of 46.5 sq.mi., lies on a series of hills and varies in altitude from sea level to 934 ft. The most notable of the hills are Telegraph, Russian, Nob, Rincon, Lone Mt., Bernal Heights, Larsen Peak, Twin Peaks, Potrero, Buena Vista, Lincoln Park, Mt. Olympus, and Mt. Davidson (934 ft.). Three cable-car lines operate on the steep streets of the city. The cable cars have been proclaimed a national monument. The Embarcadero, a crescent-shaped boulevard 200 ft. in width, borders the edge of the peninsula and is lined with vast concrete piers. From the Embarcadero the principal thoroughfare, Market St., runs diagonally to the southwest, bisecting the city. North of Market St. are the main commercial sections of the city and to the south are the older sections and industrial areas. The Civic Center, which occupies more than three square blocks, contains the City Hall, the Civic Auditorium, the Public Library, the State Building, the Federal Office Building, the Health Center, the War Memorial

SAN FRANCISCO

Building, and the Opera House. The Ferry Building, at the foot of Market St., contains several State offices. The oldest building in the city is the Mission San Francisco de Asís, or Mission Dolores, built in 1782. At the Presidio, a U.S. military reservation covering more than 1500 acres at the southern terminus of the Golden Gate Bridge, is the headquarters of the Ninth Corps Area of the U.S. Army. The city is U.S. Forest Service headquarters for twenty national forests in California and Nevada. The famous San Francisco Chinatown, in the northeastern section of the city, contains numerous interesting restaurants, theaters, temples, and bazaars.

The park system of San Francisco covers some 4000 acres. Outstanding among the parks and recreational facilities are Golden Gate Park (1000 acres), and Fleishhacker Playfield and Zoological Gardens, fronting on the Pacific Ocean and including the largest outdoor swimming pool in the world. Candlestick Park is the home of the San Francisco Giants of the baseball National League; the city is the home of the San Francisco Warriors of the National Basketball Association and the San Francisco 49ers of the National Football Conference.

Education. Educational institutions in San Francisco include the University of San Francisco (1855; Roman Catholic); San Francisco State University (q.v.); San Francisco College for Women (1921; Roman Catholic); the Medical Center, Hastings College (law), and the San Francisco Art Institute, units of the University of California; the California School of Fine Arts; Golden Gate College (1901); City College of San Francisco (1935; junior); the San Francisco Conservatory of Music; and the San Francisco Theological Seminary. Among cultural facilities are three public art galleries, the M. H. De Young Memorial Museum, the San Francisco Museum of Art, and the California Palace of the Legion of Honor. The city also maintains museums of anthropology and natural history, an aquarium, and a symphony orchestra.

Government. San Francisco has a consolidated city and county government, with legislative powers vested in an eleven-member board of supervisors. The mayor and other city officials are elected for four-year terms.

Commerce and Industry. San Francisco is the leading world trade center of the Western U.S. In a recent year the value of imports and exports passing through customs reached almost \$1.5 billion. The leading exports are canned, fresh, and dried fruits, barley, raw cotton, canned salmon, lumber, oil and gasoline, scrap iron, lead, machinery and parts, and automobiles; im-

ports include raw silk, coffee, tea, rice, sugarcopra, coconut oil, newsprint, and burlap. San Francisco, one of the largest cities in population in the U.S., is an important manufacturing and commercial center and the financial capital of the West. Chief among the numerous industries of the city and vicinity are oil refining, smelting and refining of nonferrous metals, shipbuilding, sugar refining, meat packing, printing and publishing, processing and canning of fruits and vegetables, and the manufacture of steel, tin cans and other tinware, motor-vehicle bodies and parts, paints, varnishes and lacquers, bread and other bakery products, and malt liquors. The city is the main gateway of commerce for the vast inland territory of the central Pacific coast area and Intermountain States, and its wholesale and retail establishments serve numerous important cities in the immediate trade area. The city is the headquarters of the 12th Federal Reserve District, the home of the largest bank in the world, and the site of the Pacific Coast Stock Exchange.

History. In 1776 a Spanish officer, Juan Bautista de Anza (1735–88), founded the Presidio at the northern tip of the peninsula. The Mission San Francisco de Asís was established later in the same year by the Franciscans. The settlement that developed around the fort and mission was known as Yerba Buena ("Good Herb") because of the abundance of mint in the area. In 1847 the name was changed to San Francisco. In 1848, when the territory now included in the State of California was ceded to the U.S. after the Mexican War, San Francisco had a population of only 800; with the discovery of gold in the region in 1848 the population increased to more than 10,000. In the ensuing years the city was noted for its lawlessness, to combat which the famous Vigilance Committee (see VIGILANTES) was formed in 1851. San Francisco was incorporated as a city in 1850, and development of the city as a port began about 1855. Fires have devastated San Francisco at various times. The most disastrous was that which followed the earthquake of April 18, 1906; the fire raged for three days, destroying almost the entire city; see EARTHQUAKE. Within a year San Francisco was rebuilt. In 1945 the city was the site of the United Nations Conference on International Organization; see UNITED NATIONS, THE.

Population. Between 1910 and 1950 the population of San Francisco increased from 416,912 to 775,357. In 1960 the population was 740,316, and in 1970 it was 715,674.

SAN FRANCISCO BAY, inlet of the Pacific Ocean, on the coast of California. The bay,

which is bordered by several cities, including San Francisco and Oakland, is about 50 mi. long and from 3 to 12 mi. wide. It is entered from the Pacific Ocean by a strait known as the Golden Gate (q.v.) and stretches N. and S., parallel to the coast. At the northern end it widens out into San Pablo Bay, which is connected on the N.E. with Suisun Bay by Carquinez Strait. Suisun Bay receives the waters of the Sacramento R.

SAN FRANCISCO DE MACORÍS, city in the Dominican Republic, and capital of Duarte Province, on a branch of the Camú R. in the La Vega Real valley, 60 miles N.W. of Santo Domingo. A rail terminus and the trade center of the eastern Cibao lowland, the city processes the products of the surrounding area, including cacao, coffee, fruit, corn, rice, livestock, and beeswax. It was founded in 1777 and made departmental capital in 1936. Pop. (1970) 43,941.

SAN FRANCISCO STATE UNIVERSITY, State-supported coeducational institution of higher learning, located in San Francisco, Calif., and founded as the San Francisco Normal School in 1899. The school became San Francisco State Teachers College in 1921. In 1935, when the school became a liberal arts college, its name was changed to San Francisco State College. It was renamed California State University, San Francisco, when it achieved university status in 1972. The present name was authorized by the State legislature in 1974. The degrees of bachelor and master are conferred in liberal arts, business administration, education, creative arts, sciences, ethnic studies, area studies, behavioral and social sciences, and health, physical education, and recreation. The libraries contain some 497,500 bound volumes. In 1972 enrollment totaled 25,275, and faculty numbered more than 1000.

SAN GABRIEL, city of California, in Los Angeles Co., S. of the San Gabriel Mts., 9 miles E. of downtown Los Angeles. The city manufactures electrical and electronic equipment and toys. A tourist center, it is the site of the rebuilt San Gabriel Arcángel Mission, founded in 1771, and of several adobe houses of the 18th and 19th centuries. Called San Gabriel de los Temblores in Spanish colonial days, the city was incorporated in 1913. Pop. (1960) 22,561; (1970) 29,176.

SANGER, Frederick (1918–), British biochemist, born in Rendcombe, Gloucestershire, and educated at the University of Cambridge. After graduating in 1939, Sanger taught at Cambridge and engaged in research into the metabolism (q.v.) of amino acids and the structure of insulin (q.v.). He developed a new method for analyzing the molecular structure of protein

(q.v.) and showed that a molecule of insulin contains two peptide chains, linked together by two disulfide bonds. Sanger's research facilitated further advances in the field of biochemistry by John Cowdery Kendrew and Max Ferdinand Perutz (qq.v.) of Great Britain, who in 1960 were able to prepare three-dimensional structures of protein molecules; see NUCLEIC ACIDS. Sanger received the 1958 Nobel Prize in chemistry, and in 1963 he became Commander of the Order of the British Empire.

SANGER, Margaret (1883–1966), American leader of the birth-control movement, born Margaret Higgins in Corning, N.Y. She was trained as a nurse at the White Plains Hospital in New York. Her work among the poor in New York City convinced her of the widespread need for information concerning contraception. She abandoned nursing to devote herself to the promotion of that objective, which she named "birth control". In 1914 she was indicted for circulating through the mails a magazine called *The Woman Rebel*, in which she attacked legislative restrictions on distribution of contraceptive information; see PLANNED PARENTHOOD. By publishing a pamphlet on birth control she won support from prominent community leaders; through their influence the case against her was dismissed in 1916. In the same year she established the first American birth-control clinic in Brooklyn, N.Y. Charged with "maintaining a public nuisance", she was convicted but won on appeal, opening the way for physicians to give birth-control advice in New York City. She then began publication of *Birth Control Review*, a monthly magazine, which she edited until 1928. She founded the American Birth Control League and served as its first president from 1921 to 1928. In 1927 she organized the first World Population Conference; see POPULATION STUDY. She was honorary chairman of the Planned Parenthood Federation of America, which was formed from The American Birth Control League in 1941.

Throughout her career Mrs. Sanger traveled extensively, particularly in Asia, to publicize the birth-control movement. She is the author of several works on books in the field and of *Margaret Sanger: An Autobiography* (1938).

SANGIHE ISLANDS, island group in the Celebes Sea, belonging to the Republic of Indonesia, about 30 miles N.E. of the island of Celebes. Many of the islands are actively volcanic with very fertile soil. The major products are ebony, rattan, nutmeg, and coconuts. Tahuna, a town on the island of Sangihe, is the chief port. Area, 314 sq.mi.; pop. (latest census) 194,253.

SANGRE DE CRISTO

SANGRE DE CRISTO, mountain range of s.-central Colorado and n.-central New Mexico. The range, which is very high and narrow, extends s.e. and s., for about 220 mi., from Salida, Colo., to Santa Fe County, N. Mex. It is the southernmost range of the Rocky Mountains (q.v.). Blanca Peak (14,317 ft.), in Colorado, is one of the highest mountains of the Rockies.

SANGSTER, Charles (1822–93), Canadian poet, born in Kingston, Ontario Province. He had little formal education and did clerical work in Kingston from 1838 to 1849, at the same time writing poems for Canadian magazines. In 1850 he joined a newspaper, the *Kingston Whig*, as a reporter and worked as a journalist during the next eleven years. In 1867 he went to Ottawa to become a postal official, a livelihood he pursued until shortly before his death. Sangster is important as one of the first Canadian poets to make use of Canadian themes, and his patriotic, sentimental verse was influential in gaining national support for the confederation of the Canadian provinces. His three volumes of published poems are *The St. Lawrence and the Saguenay and Other Poems* (1856), *Hesperus and Other Poems and Lyrics* (1860), and *Our Norland* (1896).

SANHEDRIN or **SANHEDRIM**, supreme national tribunal of the Jews (q.v.), established at the time of the Maccabees (q.v.). It consisted of seventy-one members and was presided over by the Nasi (Heb., "prince"), at whose side stood the Ab-Beth-Din (Heb., "father of the tribunal"). There may have been two similar bodies, a secular Sanhedrin, dominated by the Sadducees (q.v.), of which the high priest (q.v.) was Nasi, and a religious one, which was governed as a democracy of scholars, following Pharisaic ideology (see PHARISEES). It is possible that the latter body was a descendant of the Great Synagogue; see SYNAGOGUE, THE GREAT. The limits of jurisdiction of the Sanhedrin are not known, but apparently at one time the supreme decision over life and death was in its hands.

SANITARY ENGINEERING. See ENGINEERING.

SAN JACINTO, BATTLE OF, battle fought April 21, 1836, in what is now Harris County, Texas. It was the decisive contest of the Texan war of independence from Mexico; see TEXAS: History. After the massacre of the garrison of the Alamo (q.v.) by the forces of Mexican general Antonio López de Santa Anna (q.v.), the Texan commander in chief, General Sam Houston (q.v.), with a small force of 800 men, made a surprise attack on the Mexican army near the mouth of the San Jacinto R. Although the Mexican forces numbered more than 1500, they were

completely routed by the Texans and Santa Anna was taken prisoner.

SAN JOAQUIN, river of California, rising in the Sierra Nevada in Tulare County. It flows generally n.w. through central California and joins the Sacramento R. shortly before entering Suisun Bay, n.e. of Oakland. The river, which is 317 mi. long, is part of an extensive irrigation and power project that has created a rich agricultural region in the semiarid San Joaquin valley.

SAN JOSE, city in California, and county seat of Santa Clara Co., on the Guadalupe R., 8 miles s.e. of San Francisco Bay and about 40 miles s.e. of San Francisco. It is an important marketing center for the fruit-growing region of Santa Clara Valley. The major industries in the city are canning and fruit-packing plants; manufactures include agricultural machinery and electronic equipment. San Jose was founded in 1777 under orders of the viceroy of Mexico and was known as the Pueblo de San Jose de Guadalupe; the first town in California as distinguished from forts and missions. The first State legislature met here in 1849, and San Jose served as capital of the State from 1849 to 1851. Within the city limits are the County Court House (1866–68) and the campus of San Jose State University (formerly San Jose State College), which includes the home of the American poet Edwin Markham (q.v.), a graduate of the school. San Jose was chartered as a city in 1850. Pop. (1960) 204,196; (1970) 445,779.

SAN JOSÉ, city and capital of Costa Rica, and capital of San José Province, on the central plateau, 3838 ft. above sea level, 15 mi. n.w. of Cartago. It is the commercial center for the surrounding agricultural region, which produces mostly coffee and sugar. Important manufactures in the city include cocoa, chocolate, beer, textiles, and furniture. San José is the site of the University of Costa Rica (1843); notable buildings include the 18th-century cathedral and the National Museum (1887). Founded in the early 18th century, San José became the capital of Costa Rica in 1823. Pop. (1972 est.) 217,772.

SAN JOSÉ SCALE. See SCALE INSECT.

SAN JOSE STATE UNIVERSITY, coeducational State-controlled institution of higher education, located in San Jose, Calif. The college was founded in 1857 in San Francisco as Minns' Evening Normal School. In 1862 the State of California assumed the support of the school, and the institution was moved to San Jose in 1871. Its name was changed to San Jose State College in 1935, and the present name was adopted in 1972. The university has schools of applied sci-

ence and arts, business, education, engineering, humanities and the arts, science, social sciences, and social work. The degrees of bachelor and master are conferred in 136 different areas. In 1973 the college libraries housed more than 500,000 bound volumes. In the same year, approximately 28,100 students were enrolled at the university, and the teaching staff numbered approximately 1400.

SAN JUAN, city in Argentina, and capital of San Juan Province, in an arid zone irrigated by the Río San Juan, about 600 miles N.W. of Buenos Aires and 120 miles E. of the Chilean border. It is the commercial center of the second largest wine-producing area in Argentina; an area that also produces cattle, grain, and fruit. Industries in the city include food canning, bottling, distilling, meat packing, sawmilling, and the manufacture of cement. In the city are a historical museum, a provincial university, the engineering college of the Catholic University of Cuyo, and a seismological station. Sarmiento Library and Museum, the birthplace of the Argentine president and educator Domingo Faustino Sarmiento (1811–88), was one of the few buildings to survive the disastrous earthquake of 1944. Founded in 1562 as San Juan de la Frontera, the city was for many years part of Chile. Pop. (greater city; 1970) 224,000.

SAN JUAN, city, port, and capital of Puerto Rico, on the Bay of San Juan, on the N.E. coast of the island, about 40 miles N.E. of Ponce. San Juan is the largest city of Puerto Rico and is a major industrial center, and tourist resort. The port handles more than half of the total Puerto Rican export and import trade. The leading manufactures are electrical goods, metal products, cloth-

ing, cigars and cigarettes, refined sugar, and rum. The city also derives considerable revenues from the tourist industry. The main exports are sugar, coffee, tobacco, and fruit; the principal imports are livestock, foodstuffs, machinery, lumber, and iron.

The site of the city comprises an island and a mainland area, which are joined by bridges and a causeway. The modern portion of San Juan is on the mainland and includes the resort section of Condado, the principal residential district of Santurce, and the former city of Río Piedras, a rapidly expanding industrial area, which was absorbed by San Juan in 1951. The University of Puerto Rico (1903), with the associated School of Tropical Medicine (1927), is located in Río Piedras.

The older part of the city, which is built on a small island at the entrance to the harbor, was originally a Spanish fortress and is partly surrounded by a massive wall. Among the structures of historical interest are the two castles, El Morro, built between 1539 and 1584, and San Cristóbal, built in 1631; La Fortaleza, a fort that is now the residence of the governor; the 16th-century cathedral, that contains the tomb of the Spanish explorer Juan Ponce de León (q.v.); and the Church of San José, built in 1522. Forty acres containing massive masonry fortifications built by the Spanish to protect the harbor have been designated a national historic site. Several prominent modern buildings are also located in the old section.

History. The first European settlement on the site of the future city was founded on the mainland in 1508 by Juan Ponce de León, and was known as Villa de Caparra. This settlement was

Cloverleaf highway in the modern section of San Juan.

Commonwealth of Puerto Rico



SAN JUAN BOUNDARY DISPUTE

later abandoned, and in 1521 work began on the island fortifications that became San Juan. Because of its strategic location on the West Indies (q.v.) trade routes, San Juan was frequently attacked by foreign forces, and during the 16th century the Spanish constructed the series of fortresses that made the city their most powerful stronghold in the New World. In 1898, during the Spanish-American War (q.v.), United States troops were landed at San Juan. Following the cession of Puerto Rico by Spain to the U.S. in 1898, San Juan expanded in size and in economic importance. See *PUERTO RICO: History*. Pop. (1970) 452,749.

SAN JUAN BOUNDARY DISPUTE. See NORTHWEST BOUNDARY DISPUTE; WASHINGTON, TREATY OF.

SAN JUAN MOUNTAINS, mountain range extending s.e. from San Juan Co. in s.w. Colorado, to Rio Arriba Co., in n.w. New Mexico. Part of the Rocky Mountains (q.v.), it is of volcanic origin and is rich in minerals. The highest peaks are in Colorado and include Uncompahgre Peak (14,309 ft.), Mt. Sneffels (14,150 ft.), and Wetterhorn Peak (14,017 ft.).

SANKARA. See *HINDUISM*.

SAN LEANDRO, city of California, in Alameda Co., 8 miles s. of Oakland. A flower show and a cherry festival are held annually in San Leandro to celebrate the chief products of the surrounding region. Principal manufactures include scientific instruments, machinery, paper products, and metal goods. The city also has important dairy and food-processing concerns. San Leandro was founded in 1855 and incorporated as a city in 1872. Pop. (1960) 65,962; (1970) 68,698.

SAN LORENZO, unincorporated community of California, in Alameda Co., at the mouth of San Lorenzo Creek on San Francisco Bay, 10 miles s.e. of Oakland. Lying in a fruit-, vegetable-, and flower-growing region between Hayward and San Leandro, San Lorenzo manufactures electrical equipment, rubber products, and tools. The area of the present community, originally a part of the San Leandro Rancho, was called Squattersville in 1851. Pop. (1960) 23,773; (1970) 24,633.

SAN LUIS OBISPO, city in California, and county seat of San Luis Obispo Co., about 80 miles n.w. of Santa Barbara. It is the marketing center for grain and livestock from the surrounding region. Industries in the city include dairy plants and factories for the production of bricks and clothing. It is the site of the California State Polytechnic College, established in 1901. The settlement was founded in 1772 with the San Luis Obispo de Tolosa mission, which is

still used as a church. San Luis Obispo was incorporated as a city in 1856. Pop. (1960) 20,437; (1970) 28,036.

SAN LUIS POTOSÍ, city in Mexico, and capital of San Luis Potosí State, 225 miles n.w. of Mexico City. It is an important industrial center located in a rich agricultural and mining region. Silver, lead, and copper are smelted and refined in the city. Other industries include textile mills, tanneries, and a major arsenic plant. San Luis Potosí was founded in the late 16th century and is the site of the Autonomous University of San Luis Potosí, established in 1826. Pop. (1970 prelim.) 274,300.

SAN MARCOS, city in Texas, and county seat of Hays Co., on the San Marcos R., about 27 miles s.w. of Austin. A resort area and processing center, products of the city include cottonseed oil, cotton, building materials, and wool. It is the site of Southwest Texas State College, founded in 1899. San Marcos was founded about 1846 and incorporated in 1877. Pop. (1960) 12,713; (1970) 18,860.

SAN MARCOS, NATIONAL UNIVERSITY OF, officially UNIVERSIDAD NACIONAL MAYOR DE SAN MARCOS DE LIMA, autonomous coeducational institution of higher learning, located in Lima, Peru, and supported by the national government. The university was founded in 1551 by the Spanish Dominican friar Tomás de San Martín (1482–1554) through a decree of Charles V (q.v.), Holy Roman Emperor, and was approved by a papal bull issued in 1571. Previously administered by the Dominicans (q.v.), the institution was secularized in 1571 and became a state institution. The university flourished until the establishment of the republic in 1821, when the school entered a period of decline. Reorganized in 1861 and enlarged in 1874, the institution was reorganized again in 1946. The university faculties include law and political science, mathematics and physics, geology and geography, biology, veterinary science, medicine, dentistry, education, and economics. The *bachiller* or a professional title is awarded after three to five years of study and is generally the equivalent of an American baccalaureate degree. A doctorate, equivalent to an American master's degree, is awarded after further graduate study. The library contains 400,000 bound volumes. In 1972–73 the student body numbered about 20,295 and the faculty, about 2055.

SAN MARINO, city of California, in Los Angeles Co., about 3 miles s.e. of Pasadena. Primarily residential, the city has some manufacturing. The Henry E. Huntington Library and Art Gallery is located there. San Marino was incor-

porated in 1913. Pop. (1960) 13,658; (1970) 14,177.

SAN MARINO, republic of Europe, an enclave in Italy, near the Adriatic Sea, about 11 miles s.w. of Rimini, Italy. It is situated at about lat. 43°45' N. and long. 13° E. The terrain is dominated by Mt. Titano, which rises 2437 ft. above sea level. San Marino, the smallest republic in the world, has an area of about 23.5 sq.mi. The population (1947 census) was 12,100; an official estimate (1971) was 17,000. The people speak Italian, use Italian currency, and are mostly Roman Catholic. The capital and largest city is San Marino (pop. 1964 est., 2621); it is on the slopes of Mt. Titano. The quarrying of building stone, the making of wine, and the raising of livestock are the major occupations. Other important sources of income are tourism and the sale of postage stamps. In a recent year government revenues and expenditures were balanced at about \$11,000,000. San Marino is governed by a great and general council of sixty members, elected by popular vote for a term of five years. Two members of the council are elected for six months to exercise executive authority in conjunction with the congress of state, the administrative body.

History. According to tradition the republic was founded in the early 4th century A.D. by Marinus, a Christian stonecutter, who sought refuge on Mt. Titano from religious persecution. In 1291 Pope Nicholas IV (see under NICHOLAS) recognized the independence of the republic. The governing laws of San Marino, the *Statuta Illustrissimae Reipublicae*, were promulgated during the Middle Ages. The republic has had a treaty of friendship with Italy since 1861. In 1947 a Communist government was elected, remaining in power until 1957, when the Christian Democratic Party, with the aid of dissident Communists, took control of the government. The Christian Democrats continued in power in the early 1970's.

SAN MARTÍN, José de (1778–1850), South American general, born in Yapeyú, in the Viceroyalty of La Plata (now in Argentina). Early in 1814, he began to train a revolutionary army to aid the struggle for independence of the Spanish colonies in South America; see SOUTH AMERICA: *History*. In 1817 he defeated the Spanish at Chacabuco, Chile, and occupied the Chilean capital, Santiago. In 1818, following his decisive victory at Maipu, he established a nationalist government in Chile, but refused the presidency in favor of his lieutenant, the Chilean general Bernardo O'Higgins (q.v.). In 1820 San Martín organized an expedition to liberate Peru

from Spanish rule. He defeated the Spanish army at Pisco in December, 1820, and then occupied Lima, where, on July 28, 1821, he proclaimed the independence of Peru and was appointed protector of the country. The next year further Spanish resistance forced him to request the military aid of the Venezuelan general and liberator Simón Bolívar (q.v.). The two men disagreed on governmental policy and in September, 1822, San Martín resigned his position in favor of Bolívar. In 1824 San Martín went to Europe where he remained until his death.

SAN MATEO, city of California, in San Mateo Co., on San Francisco Bay, 16 miles s.e. of San Francisco. It is mainly a residential city with some light industries, food-processing plants, and shipment centers for cut flowers. It is a terminus of the San Mateo Bridge, completed in 1929, which extends 7 mi. over San Francisco Bay to Hayward. San Mateo was founded in 1863 and incorporated as a city in 1894. Pop. (1960) 69,870; (1970) 78,991.

SAN MIGUEL, city in El Salvador, capital of San Miguel Department, at the foot of San Miguel and Chinameca volcanoes, 65 miles s.e. of San Salvador. A road, rail, and trade center on the Pan American Highway (q.v.), it serves the surrounding agricultural region, which produces coffee, livestock, sisal, grain, sugarcane, and cotton. The city, formerly the center of an indigo trade, includes among its industries cotton milling, vegetable-oil and sisal processing, tanning, and the manufacture of musical instruments, handicrafts, and pharmaceuticals. The many Spanish colonial buildings include a cathedral, the Santo Domingo and Chinameca churches, and several monasteries. The city was founded in 1530. Pop. (1971 est.) 110,996.

SAN PABLO, city of California, in Contra Costa Co., s. of San Pablo Bay, about 10 miles n.w. of Berkeley. San Pablo is a major fishing port and has a number of fish-processing plants. Metal products, plumbing supplies and paints are manufactured. It is the site of Contra Costa College, established in 1950. San Pablo was incorporated in 1948. Pop. (1960) 19,687; (1970) 21,461.

SAN PABLO, city of the Philippines, in Laguna Province, on Luzon Island, s. of Lake Taal, and 45 miles s.e. of Manila. Situated in a volcanic lake region, it is the trade center for an agricultural area growing rice, sugarcane, and coconuts and is connected with Manila by rail. The city was chartered in 1940. Pop. (1971 est.) 109,200.

SAN PEDRO. See LOS ANGELES.

SAN PEDRO SULA, city in Honduras, and capital of Cortés Department, in the Sula Valley, 25

SAN RAFAEL

miles s.w. of its port at Puerto Cortés, with which it is connected by rail. The city is the commercial center of an area of banana and sugar plantations; industries include sugar milling, tanning, flour milling, brewing, bottling, meat packing, tobacco processing, sawmilling, and the manufacture of furniture, dairy products, and soap. It is the second-largest city of Honduras and the site of the José Reyes Normal School. Established in 1536, to the E. of its present location, the city was moved in the 17th century. Pop. (1971) 102,129.

SAN RAFAEL, city in California, and county seat of Marin Co., on San Francisco Bay, 15 miles N. of San Francisco. It is primarily a residential community with some manufactures, including electronic equipment and glass. San Rafael was founded in 1850 and incorporated as a city in 1874. Pop. (1960) 20,460; (1970) 38,977.

SAN REMO, city of Italy, in Liguria Region, on the Gulf of Genoa, 70 miles s.w. of Genoa. Famous for its flower market, the city also manufactures wine and olive oil and is a fishing port. It is the chief resort of the Riviera di Ponente; along the gulf are palm-lined boulevards, a casino, modern hotels and villas, gardens, and beaches. The old town ("Pigna") is the site of the 12th-century Romanesque Church of San Siro, the baroque Madonna della Costa Church, and a Genoese fort, now a prison. A cable car leads to Monte Bignone, which provides a panorama of the Italian and French Rivières. Achieving self-government in 1170, the city was later sold to Genoa. In 1920 San Remo was the site of an Allied conference following World War I. Pop. (1971) 51,400.

SAN SALVADOR or **WATLING ISLAND**, island in the Atlantic Ocean, one of the Bahama Islands, 200 miles s.e. of Nassau. The chief occupations of the inhabitants are farming, fishing, and employment in the United States military bases on the island. San Salvador is believed to be the site of the first landfall in America of the Italian-born navigator Christopher Columbus (q.v.) in 1492. Area, 60 sq.mi.; pop. (1970) 1000.

SAN SALVADOR, city and capital of El Salvador, and capital of San Salvador Department, 32 miles s.e. of Santa Ana. It lies at an altitude of 2238 ft., near the extinct volcano of San Salvador. It is a major processing center for the coffee and sugar crops of El Salvador; manufactures include textiles, liquors, and soap. Among the educational and cultural institutions located in the city are the University of El Salvador (1841) and the National Museum (1883). Founded in 1525 by the Spanish, San Salvador was temporarily removed to another location in 1528 but re-

turned to its present site in 1539. The city has been continually subject to earthquakes and few of the original buildings remain. Pop. (1972 est.) 380,000.

SAN SEBASTIÁN, city and port in Spain, and capital of Guipuzcoa Province, on the Bay of Biscay, at the mouth of the Urumea R., about 10 miles w. of Irún. It is a major fishing port and a fashionable resort with a fine beach, known as La Concha. Manufactures include electrical equipment, cement, and processed foods.

San Sebastián was founded in 1524, and the old town is built on a sandy isthmus connecting the mainland with the rocky and steep Monte Urgull, which is crowned by the 16th-century fortress of La Mota. The modern town spreads inland along the banks of the river. It is the site of one of Spain's most outstanding art galleries and of the Palace of Miramar, the summer residence of the former kings. Pop. (1970) 165,829.

SANSKRIT LANGUAGE (fr. Skr. *samskrta*, "adorned, cultivated, perfected"), the ancient sacred language of the Hindus (see HINDUISM) of India, belonging to the Indic subfamily and Eastern or Satem division of the Indo-European languages (q.v.). For the last 2000 years or more Sanskrit has led a more or less artificial life, being, like Latin during the Middle Ages (q.v.), the means of communication and literary expression of the priestly, learned, and cultivated castes of India; see SANSKRIT LITERATURE. From about the beginning of the Christian era, and increasingly later, Sanskrit has come to mean, for learned Hindus, the language as "perfected" by the rules of the grammarian Panini (fl. about 4th cent. B.C.), who soon acquired a kind of canonical authority in India. Panini's work is still studied, indeed learned by heart, by schoolboys trained according to native Indian methods. It is certainly the most scientific grammar (q.v.) ever produced in any country before the 19th century, and many consider Panini perhaps the greatest grammarian who ever lived.

Sanskrit is distinguishable most obviously from the later derived dialects, Prakrit and Pali (q.v.), whose character and forms in relation to Sanskrit are analogous to those of the Romance languages (q.v.) in their relation to Latin. On the other hand, Sanskrit is distinguished, although much less sharply, from the oldest forms of Indian speech, preserved in the religious literature of the Brahmanas, Vedas, and Upanishads (q.v.); see BRAHMA; VEDA. These forms of speech are likewise by no means free from important dialectical, stylistic, and chronological differences, but they are comprised under the one name, Vedic.

Vedic Influence. Vedic differs from Sanskrit about as much as the Greek language of the epic poet Homer (q.v.) does from classical Greek. The Vedic apparatus of grammatical forms was much richer and less definitely settled than that of Sanskrit, which gave up much of the grammar of the earlier language without, as a rule, supplying substitutes for the lost materials. Many inflectional forms of Vedic nouns and verbs disappeared in Sanskrit. The subjunctive was lost, and about a dozen Vedic infinitives were reduced to a single one in Sanskrit. By the medieval period, Sanskrit also had lost an important heirloom which had been handed down by the Indian languages (q.v.) from prehistoric times: the system of Vedic pitch or tonal accentuation, which was still in full force in Panini's time. Notwithstanding its very archaic character, Vedic is not to be regarded as a popular tongue, but as a more or less artificial "high speech", handed down through generations by families of priestly singers. Both Vedic and Sanskrit were in a sense caste languages, based upon popular idioms; see CASTE.

The Vedic people migrated in prehistoric times into India from the northwest, where Iranian languages are still spoken. It has been shown, by comparison of Vedic and Sanskrit with the oldest forms of Iranian speech, Avestan and Old Persian, that these languages are collectively merely dialects of an older idiom. This idiom is known as the Indo-Iranian or, in the narrower sense, Aryan language; see INDO-IRANIAN LANGUAGES. The reconstructed Indo-Iranian language differs less from the language of the Veda than classical Sanskrit does from Prakrit and Pali. The language of the Iranian Avesta (q.v.) is so much like that of the Veda that entire passages of either literature may be converted into a fair approximation of the other, by observing the special laws of sound peculiar to each language. See PERSIAN LANGUAGE AND LITERATURE.

Impact on Europe. One of the most important events in the history of European culture was the discovery of Sanskrit in the latter part of the 18th century. The study of this language opened up the history of the primitive Indo-European period and gave birth to the science of comparative philology, or comparative linguistics; see PHILOLOGY. Linguistic science, comparative mythology and religion (see INDIAN MYTHOLOGY), comparative jurisprudence, and other important fields of historical and philosophical study either owe their existence to the discovery of Sanskrit or were profoundly influenced by it.

After the invasion of India by Alexander III

(q.v.), King of Macedonia, called the Great, the Greeks became acquainted to a certain extent with the learning of the Hindus. In the Middle Ages the Arabs introduced the knowledge of Indian science to the West, including the so-called Arabic numerals, which were originally Indian. Beginning with the 16th century, European nations, namely Portugal, the Netherlands, England, and France, obtained a foothold in India through colonization; see INDIA: History. European missionaries consequently acquired some familiarity with Sanskrit language and literature. The first Sanskrit grammar to be published in Europe, that of Father Paulinus a Sancto Bartholomeo, was printed in Rome in 1790. English scholars in India, notably Sir William Jones (q.v.), Sir Charles Wilkins (1749?–1836), Henry Thomas Colebrooke (1765–1837), and Horace Hayman Wilson (1786–1860) were the first real mediators between India and Europe. Wilkins' translation of the *Bhagavad-Gita* (q.v.) and Jones' translation of the *Sakuntala* elicited the greatest admiration. Especially in Germany, literary men and scholars such as Johann Gottfried von Herder, Johann Wolfgang von Goethe, the brothers Friedrich and August Wilhelm von Schlegel, and Wilhelm von Humboldt (qq.v.) were attracted to the new language, its literature, and its history and prehistory. Since the German philologist Franz Bopp (q.v.) laid the foundation of the science of comparative grammar, both Indology and comparative philology have been important areas of study.

The Sanskrit language has on the whole preserved the linguistic conditions of the putative Indo-European parent speech better than any other member of the Indo-European family of languages, with the possible exception of ancient Greek. The preservation of the Indo-European vocalic liquids, *r* and *l*, as Skr. *r*, as in Indo-Eur. *é-drk-om*, I have seen, Skr. *á-drś-am*, or Indo-Eur. *wl̥qo-s*, wolf, Skr. *vṛka-s*, led to the recognition that vocalic liquids, and also vocalic nasals (*m*, *n*), belonged to the original stock of the whole family of languages and was followed by far-reaching and permanent results concerning the entire system of vocalism; see VOICE AND SPEECH. The preservation of the old system of accentuation, confirmed in large measure by Greek and to some extent by other related languages, in many texts of the Veda and in Panini, made it possible for the Danish philologist Karl Adolph Verner (q.v.) to discover his famous law. Known as Verner's Law (q.v.), the discovery explained some apparent exceptions to Grimm's Law (q.v.). See PHONETIC LAW. F.E. & H.M.H.

SANSKRIT LITERATURE. Literature in Sanskrit which like the language may be divided into two periods, the Vedic and the Sanskrit; see *SANSKRIT LANGUAGE*. Notwithstanding the chronological continuity of the Hindu writings, the spirit of Sanskrit literature differs greatly from that of the Veda. The chief distinction between the two periods is that the Veda (q.v.) is essentially a religious collection, whereas Sanskrit literature is, with rare exceptions, secular. In the Veda the Vedic and legendary forms are in the service of prayer or exposition of the ritual; in Sanskrit epic on the other hand, didactic, lyric, and dramatic forms have been developed far beyond their earlier state for more purely literary, esthetic, or moral purposes. In Sanskrit literature, moreover, with the exception of the *Mahabharata* and the *Puranas* (q.v.), the authors are generally definite persons, more or less well known, whereas the Vedic writings go back either to families of poets or to schools of religious learning.

The form and style of Sanskrit literature is, as a rule, different from that of the Vedas. Vedic prose was developed in the *Yajur-Vedas*, *Brahmanas* and *Upanishads* (q.v.) to a tolerably high pitch; in Sanskrit, aside from the strained scientific language of philosophical and grammatical treatises, prose writing is to be found only in fables, fairy tales, romances, and partially in the drama. Nor has this prose improved in stylistic quality, as compared with its earlier counterpart. On the contrary it has become progressively more awkward, full of long, difficult compounds and rhetorical constructions. Sanskrit poetry also differs from the Veda. The bulk of the poetry, especially the epic, is composed in the *śloka* meter, a development of the Vedic *anushhtubh* stanza of four octosyllabic lines of essentially iambic cadence. Numerous other meters, however, usually built up on Vedic prototypes, have become more elaborate than their old originals, and in the main, more artistic and beautiful.

Poetry. Sanskrit literature may be divided into epic, lyric, didactic, dramatic, and narrative verses and didactic, dramatic, and narrative prose. Epic poetry falls into two classes, the freer narrative epic, termed *itihāsa* (legend) or *purāna* (ancient tale), and the artistic or artificial epic, called *kāvya* (poetic product). The great epic called the *Mahabharata* is by far the most important representative of the *purāna*. Of somewhat similar free style are the eighteen *purānas* of a much later date. The beginnings of the artistic style are seen in the other great Hindu epic, the *Ramayana* (q.v.). The finished

epic *kāvya* form, however, is not evolved until the time of Kālidāsa (q.v.), about the 5th century A.D. This poet and dramatist is the author of the two best-known Sanskrit artistic epics, the *Kumarasambhava* and the *Raghuvamśa*.

Lyric poetry has its individual traits, the most important of which is the refined elaboration of the single strophe, as opposed to continuous composition. The forms of these strophes are very elaborate and almost infinitely varied. The most elaborated of the longer lyric compositions are the *Meghaduta* and the *Ritusamhara*, both works by Kālidāsa. The theme of the former work is a message sent on a cloud by an exiled yaksha, or elf, to his love. The *Ritusamhara* is famous for its descriptions of tropical nature in India, interspersed with expressions of human emotion.

The bulk of lyrical poetry, however, is in single miniature stanzas which suggest strongly the didactic proverb poetry that the Hindus also cultivated with great success. The most famous collection of such stanzas, that of Bhartrihari (d. 650), perhaps the greatest poet of India next to Kālidāsa, consists of lyric, didactic, and erotic poems. The second great master of the erotic stanza is Amaru, who is probably of a later date than Bhartrihari. His collection is known as *Amarusataka*.

Even in lyrics, however, the Hindu's tendency toward speculation and reflection is evident. Not only has this tendency been the basis of much that is best in the religion and philosophy of India, but it has also assumed shape in another important product of Hindu literature, the gnomic, didactic, sententious stanza, which may be called the Proverb. Böttlingk has collected from all parts of Sanskrit literature some 8000 of these stanzas; they begin with the *Mahabharata* and are found in almost every moral appended to the fable literature. Their keynote is again the vanity of human life and the sublime happiness that attends withdrawal from the world.

Drama. The Sanskrit drama is one of the latest, although one of the most interesting, products of Sanskrit literature. This class of works probably dates from the 5th or 6th century A.D.; certain Vedic hymns in dialogue are all that the earliest time suggests as a possible, but very doubtful, basis of the drama. The Sanskrit name for drama is *nataka*, from the root *nat*, *nrit*, to dance. The word therefore means literally ballet and it is certain that dances contributed to the development of the drama. Dancing played a considerable part in various religious ceremonies; at a later period the cult of Siva and Vishnu (q.v.),

and especially of Vishnu's incarnation, the god Krishna (q.v.), was accompanied by pantomimic dances. The pantomimes reproduced the heroic deeds of these gods and were accompanied by songs. Popular performances of this sort, the so-called *Yatras*, have survived to the present day in the Bengal region of the Indian subcontinent.

The themes of Hindu drama are for the most part those of the heroic legend in the epics or existing Hindu courts. On the whole the dramatic themes are not different from those of the tales and romances in narrative form.

The chief dramatic writer of India is Kālidāsa, the author of *Sakuntala*, master also of epic and lyric poetry. From a time somewhat earlier than that of Kālidāsa comes the drama *Mricchakatika*, said to have been written by King Sudraka, but more probably composed by Dandin (fl. 6th century) or by some other poet at Sudraka's court. During the 7th century a king named Harsha is reputed to have written three well-known dramas. From the 8th century date the dramas of Bhavabhūti (q.v.), who is, next to Kālidāsa and Sudraka (Dandin), the most distinguished of the Hindu dramatists.

Prose. No department of Indian literature is more interesting to the student of comparative literature than that comprising the fables and fairy tales. Scarcely a single motive of European fable collections is not to be found in some Hindu collection, and there is good reason for believing that the bulk of this kind of literature originated in India. The earliest and most important collection of Hindu fables is Buddhistic and is written in the Pali language (see PAU); it appears to date back to the 4th century B.C. This collection is known as the *Jatakas*. The two most important Sanskrit collections, the *Panchatantra* and the *Hitopadesa*, are both based upon Buddhist sources. A noteworthy feature of the Sanskrit collections of fables and fairy tales is the insertion of a number of different stories within the frame of a single narrative, a style of narration which was borrowed by other Oriental peoples, the most familiar instance being that of the *Arabian Nights* (q.v.). The *Panchatantra* passed from the Pahlavi into Arabic, Greek, Persian, Turkish, Syriac, Hebrew, Latin, and German, and from German into other European languages. The *Hitopadesa*, said to have been composed by Narayana, purports to be an excerpt from the *Panchatantra* and other books. The most famous collection of fairy tales is the very extensive *Kathasaritsagara*, composed by the Kashmirian poet Somadeva about 1070 A.D.

India abounds in all forms of scientific literature, written in tolerably good Sanskrit even to

the present day. The ancient legal books of the Veda continue in modern poetical *Dharmasāstras* and *Smritis*, of which the *Law-Books of Manu* (see MANU) and *Yajñavalkya* are the most famous examples. Rooted in the *Upanishads* are the six Hindu systems of philosophy (*Vedānta*, *Yoga* (qq.v.), *Mīmāṃsā*, *Nyāya*, *Sāṅkhya*, and *Vaiśeṣika*) and their abundant writings. Grammar, etymology, lexicography, prosody, rhetoric, music, and architecture each have a technical literature of wide scope and importance. The earliest works of an etymological character are the Vedic glosses of Yaska; later (4th cent. B.C.), but far more important, is the grammar of Panini (q.v.) and his commentators Katyayana and Patañjali (fl. 150 B.C.). Mathematics and astronomy were eagerly cultivated from very early times, the so-called Arabic numerals coming to the Arabs from India, and designated by them as Hindu numerals; see ARITHMETIC: *History*. Indian medical science must have begun to develop before the beginning of our era, for one of its chief authorities, Caraka, was the chief physician of King Kanishka in the 1st century A.D. The beginnings of Hindu medical science reach back to the *Atharva-Veda*. F.E. & H.M.H.

SANSOVINO, Andrea, real name ANDREA CONTUCCI (1460–1529), Italian sculptor and architect, born in Monte Sansovino, near Arezzo. He worked mainly in Florence, Rome, and Loreto. His major sculptures include the marble group the *Baptism of Christ* (1502) in the baptistry in Florence and a series of reliefs (1514–27) for the Santa Casa sanctuary in Loreto.

SANSOVINO, Jacopo, real name JACOPO TATTI (1477–1570), Italian sculptor and architect, born in Florence. He was a pupil of Italian sculptor and architect Andrea Sansovino (q.v.), whose name he adopted. In 1529 he was appointed state architect of Venice, where his works include the palace, Palazzo Corner della Ca' Grande (1532) and the library of Saint Mark's Cathedral, begun in 1536.

SAN STEFANO, TREATY OF, treaty signed by Russia and Turkey on March 3, 1878, at the Turkish village of San Stefano (present-day Yeşilköy), concluding the Russo-Turkish War of 1877–78. By its terms, the independence of Serbia, Montenegro, Rumania, and Bulgaria was recognized, and Russia obtained the right to occupy Bulgaria for a period of two years. In addition, Turkey was to surrender the Ardahan, Kars, Batum, and Bayazid areas to Russia and pay a large indemnity. See BALKAN WARS; RUSSO-TURKISH WARS. These territorial gains by Russia caused alarm to other nations, and a congress was called at which the Treaty of San Stefano was replaced by

SANTA ANA

the 1898 moderate Treaty of Berlin, signed on July 1, 1878. *See* BRITISH CONQUEST OF
SANTA ANA, city in California, and county seat of Orange Co., on the Santa Ana R., 15 miles from Long Beach. It is a major manufacturing center for a variety of products and has large electronics plants as well as food-processing facilities for the fruits and vegetables grown in the surrounding area. Most of the city was rebuilt after a severe earthquake in 1933. It is the site of the Bower Museum containing relics of early California history. The city was founded in 1869 and incorporated in 1886. Pop. (1960) 100,350; (1970) 156,607.

SANTA ANA, city in El Salvador, and capital of Santa Ana Department, at an altitude of 2123 ft., 32 miles N.W. of San Salvador. It is the second largest city of El Salvador, and is the processing and marketing center for coffee, sugar, and grain produced in the surrounding region. Other industries in the city include breweries and cotton mills. The cathedral at Santa Ana is a fine example of Spanish Gothic architecture. Pop. (1971) 172,300.

SANTA ANNA, Antonio López de or **SANTA ANA, Antonio López de** (1795?-1876), Mexican general and statesman, born in Jalapa Enriquez. In 1821 he joined the revolt against the Spaniards that resulted in the independence of Mexico; *see* MEXICO: *History*. During the following years, Santa Anna gained the support of the army and the conservative landowners in Mexico and in 1833 he was elected president. He commanded the Mexican army during the Texas Revolution of 1835-36; *see* TEXAS: *History*. Santa Anna gained full dictatorial powers in 1841, but a revolt of moderates drove him into exile in 1845. The following year, he was recalled to the presidency and assumed command of the army against the United States in the Mexican War (q.v.). Following the Mexican defeat in 1848, he fled to Jamaica. In 1853 he was recalled and made president for life, but his harsh administration and embezzlement of state funds led to his overthrow two years later.

SANTA BARBARA, city in California, and county seat of Santa Barbara Co., on Santa Barbara Channel, about 85 miles N.W. of Los Angeles. It is in a rich agricultural and oil-producing region. Santa Barbara is a popular resort and mainly a residential city, with some light industry. It is the site of the Santa Barbara campus of the University of California. Santa Barbara, which is noted for its Spanish colonial architecture, was founded by the Spanish in 1782 and incorporated as a city in 1850. In 1969 an offshore oil-drilling accident in the Santa Barbara

channel was responsible for the escape of 235,000 gallons of crude oil that spread an 800 sq.mi. oil slick on the Pacific. Pop. (1960) 58,768; (1970) 70,215.

SANTA BARBARA ISLANDS. *See* CALIFORNIA: *The Land*.

SANTA CATALINA, island of California, part of Los Angeles Co., one of the Santa Barbara Islands, in the Gulf of Santa Catalina. The island is rugged and mountainous with an irregular coast line. It is a popular resort and center for sport fishing; tourism is the principal industry. The only city is Avalon, on the S.E. coast. The island was discovered in 1542 by the Portuguese explorer Juan Rodríguez Cabrillo (q.v.). In 1919 Santa Catalina was purchased by the American industrialist William Wrigley, Jr. (1861-1932), who developed the resort facilities. His family still owns much of the island. Area, 75 sq.mi.

SANTA CLARA, city of California, in Santa Clara Co., adjacent to the city of San Jose, and 47 miles S.E. of San Francisco. It is an important processing center for agricultural produce from the Santa Clara Valley. Manufactures include electrical equipment, chemicals, glass, and paper products. The city is the site of the University of Santa Clara, founded in 1851. Santa Clara was settled in 1777 and incorporated as a city in 1852. Pop. (1960) 58,880; (1970) 87,717.

SANTA CLARA, city in Cuba, and capital of Santa Clara Province, about 184 miles S.E. of Havana. It is an important commercial center for minerals, sugarcane, and livestock from the surrounding region. Industries include sugar refineries, tanneries, and cigar factories. The city, which was founded in 1689, is the site of Cubanacan, the ancient Indian village that the Italian-born navigator Christopher Columbus believed to be a palace of the Mongol chief Kublai Khan (qq.v.). Pop. (1970 prelim.) 131,504.

SANTA CRUZ, city and port in California, and county seat of Santa Cruz Co., at the mouth of the San Lorenzo R. on Monterey Bay, about 60 miles S. of San Francisco. It is a commercial fishing port and a processing center for agricultural products and flowers. Manufactures include electronic equipment and furniture. Santa Cruz is also a popular tourist resort. It is the site of the Santa Cruz campus of the University of California. The settlement was founded with the Santa Cruz Mission in 1791 and it was incorporated as a city in 1866. Pop. (1960) 25,596; (1970) 32,076.

SANTA CRUZ, city in Bolivia, and capital of Santa Cruz Department, on the Piray R. in the tropical llanos (plains) E. of the Andes Mts., about 200 miles E. of Cochabamba. A road and

rail hub, it is connected to the main Bolivian rail network, as well as to the Brazilian and Argentine frontiers. The city is a major trade center in an area producing cattle, cotton, sugarcane, coffee, tobacco, rice, fruits, vanilla, and corn. Oil and gas fields lie nearby. Local industries include oil refining, sugar and textile milling, tanning, sawmilling, and the manufacture of alcohol, tobacco products, and confectionery. The city has a university and a bacteriological institute, and in the vicinity are several pioneer settlements. Founded in 1560 by Spanish colonists from Paraguay, Santa Cruz was moved to its present site in 1595. It was an early center of revolutionary activity against Spanish control and was briefly independent in 1811. The city is also known as Santa Cruz de la Sierra. Pop. (1970 est.) 124,900.

SANTA CRUZ, Andrés (1794–1865), Bolivian general and politician, born in La Paz. From 1820 to 1823 he fought in the war of independence of the South American colonies against Spain, and in 1828 he was elected president of Bolivia. With the aim of creating a union between Bolivia and the adjacent country of Peru, he invaded Peru in 1836 and was appointed protector. The confederation was opposed by neighboring countries, however, and in 1839 Santa Cruz was defeated by a Chilean force at the Battle of Yungay and was forced to flee to Europe. See *BOLIVIA: History*; *SOUTH AMERICA: History*.

SANTA CRUZ DE TENERIFE, city and port in Spain, and capital of Santa Cruz de Tenerife Department, on the N.E. coast of Tenerife, the largest of the Canary Islands, 55 miles N.W. of Las Palmas. It is a major fueling port for shipping; principal exports are fruits and vegetables grown on the island. Surrounded by beautiful scenery, the city is the center of a resort area, and tourism is a major industry. Santa Cruz de Tenerife was founded in 1494. Pop. (1970) 151,361.

SANTA FE, city and capital of New Mexico, and county seat of Santa Fe Co., on the Santa Fe R., 55 miles N.E. of Albuquerque. The city is situated 6954 ft. above sea level in an important mining and agricultural region of the Sangre de Cristo Mts. It is a major tourist resort and a commercial center for American Indian handicrafts. Manufactures include pumice products and electronic instruments. Several important cultural institutions are located at Santa Fe, including the Museum of New Mexico. Historic structures include the Palace of the Governors, built of adobe in 1610, considered America's oldest public building, and San Miguel Church, completed about 1636.



San Miguel Mission, in Santa Fe, the oldest mission church in the U.S.
New Mexico Dept. of Development

Founded by the Spanish in 1610, Santa Fe was a center of Spanish colonial America until 1821, when it became a part of Mexico. Trade with the United States over the Santa Fe Trail (q.v.) from Independence, Mo., began soon afterward. In 1846, during the Mexican War (q.v.), the city surrendered to U.S. forces. Santa Fe became capital of the New Mexico Territory in 1851 and of the State of New Mexico in 1912. Pop. (1960) 33,394; (1970) 41,167.

SANTA FE, city in Argentina, and capital of Santa Fe Province, near the junction of the Paraná and Salado rivers, 240 miles N.W. of Buenos Aires and opposite the city of Paraná. The city is connected by canal with the port of Colastiné on the Río Paraná. Santa Fe is the commercial and transportation center for a rich agricultural area that produces grain, vegetable oils, and meats. The city is the seat of the National University of the Littoral, several museums, and a number of buildings erected during colonial times. Santa Fe was founded nearby in 1573, and moved to the present site in 1653. Pop. (1970) 244,579.

SANTA FE TRAIL, overland trade route, extending from western Missouri to Santa Fe (now in New Mexico). The trail was in use almost continuously from 1822 to 1880, when a railroad reached Santa Fe.

SANTA ISABEL, former name of MALABO, city, port, and capital of Equatorial Guinea, and capital of Macías Nguema Biyogo (province), on the island of Macías Nguema, on the Bight of

SANTA MARIA

Bornu. The chief port and center of the island of Macías Nguema. Santa Isabel lies at the mouth of the Rio Consol, at the foot of Santa Isabel peak. The city exports coffee, cacao, copra, palm products, nuts, citrus fruits, and timber; it also has a fishing industry and engages in fish processing and local manufacturing. The modern city is centered around the governor's palace and the cathedral. Founded by the British in 1827 during a brief occupation, it was called Clarencetown, or Port Clarence. Spain reoccupied the island in 1843 and renamed the city. Pop. (1970 est.) 19,341.

SANTA MARIA, city of California, in Santa Barbara Co., on the Santa Maria R., 75 miles N.W. of Santa Barbara. A market center for vegetables, beans, grains, sugar beets, and cattle, it also has a major trade in flower seeds and bulbs. Oil fields, developed after 1900, lie nearby. Fruit processing and the manufacture of phonograph records, ceramics, machine products, stock feed, and dairy products are major industries. The city is the site of Allan Hancock College (junior college; 1920), and nearby are Hancock Field, site of the College of Aeronautics of the University of Southern California, and Vandenberg Air Force Base, a missile base. The area was settled in 1840 and named Central City in 1874; the city was planned in 1875 and incorporated in 1882. Pop. (1960) 20,027; (1970) 32,749.

SANTA MARIA, city of Brazil, in Rio Grande do Sul State, at the southern foot of the Serra Geral near the Jacuí R. valley, 150 miles W. of Porto Alegre. A road and rail hub in a fertile region producing livestock, sugarcane, coffee, grains, fruits, rice, and timber, the city has railroad shops, tanneries, sawmills, breweries, and meat- and fruit-processing plants. A college of pharmacy is located here. The city was formerly also called Santa Maria da Bôca do Monte. Pop. (1970) 120,667.

SANTA MARTA, city in Colombia, and capital of Magdalena Department, on a deep bay of the Caribbean Sea at the mouth of the Manzanares R., at the northwestern foot of the Sierra Nevada de Santa Marta, 450 miles N. of Bogotá. In an area growing bananas, cotton, tobacco, and livestock, the city exports bananas, hides, and coffee. Industries are fishing, fish canning, brewing, and the manufacture of brick and tile. The city is the terminus of the Atlántico Railroad. Among the oldest permanent European settlements in Latin America and a major port on the "Spanish Main" since colonial days, the city contains a cathedral (which once housed the tomb of the South American revolutionary leader Simón Bolívar), Fort San Fernando, and

the ruins of the Santo Domingo Monastery. Bolívar died at the San Pedro Alejandrino estate, now a museum, 3 mi. to the S. Founded in 1523, the city suffered many raids, notably by the English navigator Sir Francis Drake (q.v.) in 1586 and 1596 and by pirates in the 17th century. Pop. (1972 est.) 165,500.

SANTA MONICA, city of California, in Los Angeles Co., on Santa Monica Bay, 15 miles W. of Los Angeles. Chiefly a residential and resort city, it is also the site of several light industries and a large aircraft factory. Santa Monica was incorporated as a town in 1886 and as a city in 1902. Pop. (1960) 83,249; (1970) 88,289.

SANTANDER, city and port in Spain, and capital of Santander Province, on the Bay of Biscay, 215 miles N. of Madrid. Santander has a spacious harbor and is one of the principal industrial centers of northern Spain. A major export is iron ore, which is mined in the surrounding region and smelted at foundries in the city. Other industries include food-processing plants, shipyards, and factories in which metal goods are manufactured. Santander was the chief port of the medieval kingdom of Castile (q.v.), and the old section of the city is the site of a 13th-century Gothic cathedral. Pop. (1970) 149,704.

SANTA PAULA, city of California, in Ventura Co., about 14 miles N.E. of Ventura. Chief agricultural products of the area are citrus fruits and nuts. Major industries include oil refining and the production of clothing, plastic, oil, and asphalt. Founded in the 1870's, Santa Paula was incorporated in 1902. Pop. (1960) 13,279; (1970) 18,001.

SANTA ROSA, city in California, and county seat of Sonoma Co., on Santa Rosa Creek, 51 miles N.W. of San Francisco. Santa Rosa is the shipping point and processing center of a large fruit-growing region. The city is also close to the redwood forests of northern California, and lumber products are important. Other industries include food-processing plants and clothing factories. Luther Burbank (q.v.) lived there from 1875. Pop. (1960) 31,027; (1970) 50,006.

SANTA TECLA, city in El Salvador, and capital of La Libertad Department, at the southern foot of San Salvador volcano, 7 miles W. of San Salvador. The city has many large estates and is in an area of coffee plantations and livestock farms. Situated on the Pan American Highway, it has local industries and manufactures leather products, soap, and candles. The city was founded as Nueva Ciudad de San Salvador in 1854 after San Salvador, the capital, had been destroyed by an earthquake; it served as capital of the republic from 1855 to 1859 and became departmental

capital in 1865. It is sometimes also called Nueva San Salvador. Pop. (1971 est.) 55,718.

SANTAYANA, George (1863–1952), American philosopher, poet, and novelist, born in Madrid, Spain, and educated at Harvard University. His father brought him to Boston, Mass., in 1872. After leaving Harvard he continued his studies



George Santayana

Charles Scribner's Sons

in Germany and England, returning in 1889 to join the faculty at Harvard. His first published work was a volume of poetry entitled *Sonnets and Other Verses* (1894). He was professor of philosophy at Harvard from 1907 to 1912, when he moved to Oxford, England. After World War I, he made his home in Rome, Italy.

Santayana systematically developed his ethical philosophy in his first major work, *The Life of Reason* (5 vol., 1905–06), in which he attempted to unify science, art, and religion on a naturalistic basis by interpreting each as a different but equally valid mode of symbolism (q.v.). His personal impressions of his colleagues at Harvard and of their philosophical views are recorded in *Character and Opinion in the United States* (1920), in which he expresses both appreciation and trenchant criticism of American thought. As a leading member of the philosophical school of critical realism that developed in the U.S. in the 1920's, he maintained that reality is entirely external to consciousness and is known therefore only by inference from the sensory data within consciousness.

Santayana developed a complex theory of the structure of reality and its relation to consciousness in *Skepticism and Animal Faith* (1923) and in *Realms of Being* (5 vol., 1927–40). In these works he reduced mind to an emergent prop-

erty of matter; distinguished material reality from essences, that is, qualities and forms that are mere possibilities; and maintained that all beliefs about the external world rest on a so-called animal faith. His other writings include the philosophical and critical works *The Sense of Beauty* (1896), *Three Philosophical Poets* (1910), *Winds of Doctrine* (1913), *Dialogues in Limbo* (1926), and *Dominations and Powers* (1951); the novel *The Last Puritan* (1936); and three volumes of autobiography, *Persons and Places* (1944), *The Middle Span* (1945), and *My Host the World* (posthumous, 1953).

Santayana's influence on American thought was pervasive, although he did not found a philosophic school. His sharp but basically sympathetic criticisms of pragmatism (q.v.) stimulated the American philosopher John Dewey (q.v.) and others to refine their position. By recognizing value in disinterested objectivity and aesthetic contemplation, as well as in practical accomplishment, he helped to make pragmatism a more subtle and comprehensive philosophy. Santayana's cultivated style and blend of aesthetic sensibility with rational thought gave a literary and humanistic tone to American philosophical discourse. See PHILOSOPHY: *Modern Philosophy: Evolutionary Philosophy*. R.A.

SANTEE, river of South Carolina, formed in the center of the State by the confluence of the Congaree and Wateree rivers. The first 40 mi. of the river was dammed in 1941 by the Santee Dam to form Lake Marion, part of a major hydroelectric and navigation development. The Santee then flows s.e. for about 100 mi. and empties into the Atlantic Ocean about 15 miles s. of Georgetown, S.C. The river is 438 mi. long.

SANTIAGO, city and capital of Chile, in Santiago Province, on the Mapocho R., 60 miles s.e. of

The Congress Building in Santiago.

Panagra



SANTIAGO

the port of Valparaíso. Santiago is the principal commercial, industrial, and cultural center of Chile. It has a busy stock exchange, and over half the manufactures of the country are produced in the city, including textiles, leather goods, chemicals, and processed foodstuffs. Among the many cultural institutions located in Santiago are the University of Chile, founded in 1738, the Pontifical Catholic University of Chile, established in 1888, and several museums and libraries. Santiago was founded in 1541 by the Spanish soldier Pedro de Valdivia (q.v.). It became the capital of Chile in 1818. Pop. (1970) 2,661,920.

SANTIAGO, or **SANTIAGO DE LOS CABALLEROS**, city in the Dominican Republic, and capital of Santiago Province, on the Yaque del Norte R., about 65 miles N.W. of Santo Domingo. It is in the center of the most fertile and healthful valley of the Dominican Republic, the Cibao Valley, and is the largest town of the interior, with a flourishing trade in rice, tobacco, coffee, cacao, and hides. The chief industry is the manufacture of tobacco products. The city was founded about 1504 by the Spanish led by the Italian navigator Bartholomew Columbus (1443?-1514?), the brother of Christopher Columbus (q.v.). It was destroyed by an earthquake in 1564 and rebuilt close to the original site. Pop. (1970) 155,151.

SANTIAGO, BATTLE OF, engagement in the Spanish-American War (q.v.), fought on July 3, 1898, at the city of Santiago de Cuba (q.v.), on the island of Cuba. The city became the objective of the American attack when the Spanish fleet under Admiral Pascual Cervera y Topete (1839-1909) took refuge in the harbor. On July 1 the American army under General William Rufus Shafter (1835-1906) stormed Caney and San Juan hills, in front of the city. The harbor was blockaded by an American naval squadron under Commander William Thomas Sampson (1840-1902) and on July 3 the Spanish fleet, attempting to escape, was destroyed outside the harbor entrance. On July 14 the commander of the Spanish land forces capitulated, and the city was formally surrendered on July 17.

SANTIAGO DE COMPOSTELA, city of Spain, in La Coruña Province, 33 miles S.W. of La Coruña. Principal manufactures in the city are linen, soap, and religious articles. Santiago de Compostela has been a major place of pilgrimage in the Roman Catholic Church since the 9th century, when the discovery was made there of the alleged bones of the apostle Saint James the Great (see under JAMES). Chief among the numerous medieval buildings in the city is the fine

Romanesque cathedral, consecrated in 1128 which now contains the tomb of St. James. Pop. (1970) 70,893.

SANTIAGO DE CUBA, city and port in Cuba and capital of Santiago de Cuba Province, on the Bay of Santiago, about 460 miles S.E. of Havana. The deep, landlocked bay forms a natural harbor and the city, which is a major seaport, is the export center for copper, iron, and agricultural products from the surrounding region. Industries include foundries, distilleries, and factories in which cigars, soap, and building materials are produced. Santiago de Cuba was founded in 1514 by the Spanish soldier Diego Velásquez (q.v.). In 1898 it was the scene of a decisive battle of the Spanish-American War (q.v.); see **SANTIAGO, BATTLE OF**. On July 25, 1953, the Moncada army barracks in Santiago were the object of an abortive attack by a force under the Cuban revolutionary leader Fidel Castro (q.v.); the engagement marked the beginning of his ultimately successful revolution; see **CUBA: History**. Pop. (1970 prelim.) 275,970.

SANTIAGO DEL ESTERO, city in Argentina, and capital of Santiago del Estero Province, on the Río Dulce, 575 miles N.W. of Buenos Aires. The city is in the center of an extensive but largely semiarid agricultural region. Founded in 1553, Santiago del Estero is the oldest city in Argentina, but except for several churches, it has little colonial architecture. Pop. (greater city; 1970) 105,209.

SANTIAGO, RÍO GRANDE DE, river of Mexico. Together with the Lerma R., it forms the longest river system in Mexico. The Río Grande de Santiago rises in Lake Chapala in Jalisco State and flows about 275 miles N.W. to the Pacific Ocean, emptying 10 miles N.W. of San Blas in Nayarit State. The famous falls of Juanacatlán are on the Río Grande de Santiago in Jalisco State. The river is not navigable but is used for water-power and irrigation.

SANTO DOMINGO, formerly **CIUDAD TRUJILLO**, largest city, chief seaport, and capital of the Dominican Republic, and capital of the Federal District, on the Caribbean Sea, on the S.E. coast of Hispaniola, about 85 miles S.E. of Santiago. Located at the point where the Ozama R. flows into the Caribbean Sea, the city has a fine artificial harbor accessible to most commercial and passenger ships. It is connected by both ship and airlines with principal points in North and South America and is at the hub of a network of modern roads. Santo Domingo is a tourist, economic, and administrative center. It is the site of factories manufacturing alcoholic beverages, cement, and textiles and serves as a

distribution outlet for the sugarcane, beef and cattle, and other products of the surrounding region. Points of interest include the Cathedral of Santa María la Menor (built 1514–20), containing the tomb of the Italian-born navigator Christopher Columbus (q.v.); the ruins of the palace of Columbus' brother Diego Columbus (1450?–1515); 16th-century churches, such as San Nicolás and San Francisco; and the fortified walls of the original Spanish town. Educational and cultural institutions include the University of Santo Domingo, dating from 1538 and said to be the oldest university in the Americas.

History. Founded in 1496 by Bartholomew Columbus (1445?–1514?), brother of the explorer Christopher Columbus, the city is the oldest European settlement extant in the New World. In 1930 it was heavily damaged by a hurricane but was subsequently rebuilt. In 1936 it was renamed Ciudad Trujillo for the Dominican dictator President Rafael Leonidas Trujillo Molina (q.v.). It became Santo Domingo again in 1961 after the assassination of Trujillo and the subsequent fall of his regime. In 1965 the city was the scene of an uprising against the ruling government of the Dominican Republic. See DOMINICAN REPUBLIC: *History*. Pop. (1970 prelim.) 671,402.

SANTOS, city and port of Brazil, in São Paulo State, on the island of São Vicente, about 30 miles S.E. of São Paulo. The leading port of Brazil and outlet to the sea for São Paulo, the largest city of the country, Santos is the world's center for the coffee trade. Other exports include fruits, cotton, and meat. Machinery is among the chief imports. The modern harbor has about 4 mi. of docks. The most prominent building in the city is the Coffee Exchange. Founded in 1543, Santos became a great port when the railway from the interior was completed in 1867. Pop. (1970 prelim.) 341,317.

SANTOS-DUMONT, Alberto (1873–1932), Brazilian aeronaut and designer of dirigible balloons, born in Palmyra (now Santos Dumont), Minas Gerais State. In 1897 he attempted his first balloon ascent at Paris. The following year he successfully launched a cylindrical balloon. In 1901 he won a prize by flying his dirigible, which was 66 ft. long and 11½ ft. in diameter with a propeller operated by a 4.5 h.p. gasoline engine, from Saint-Cloud to the Eiffel Tower and back, a trip of less than an hour. In 1902 he tried to cross the Mediterranean in this ship but crashed into the sea. In 1909 he produced a monoplane called the grasshopper. See AIRSHIP. **SANUSI** or **SENUSSI**, Islamic sect in northern Africa, founded in 1837 by the Algerian religious

leader Muhammad ibn-'Alī al-Sanūsī (1791–1851). This sect was dedicated to the purification and simplification of the Islam faith in opposition to the prevalent reform tendencies. Developing secular power, the Sanusi, strong in Libya, fought on the side of the Turks in the Turko-Italian War of 1911; see TURKEY: *History: Constitutional Monarchy*. They also fought with the Central Powers in World War I (q.v.). In 1950 Emir Sayid Idris el-Sanusi (1890–), who was the head of the government of the province of Cyrenaica and the temporal and spiritual leader of the Sanusi, became the first Libyan king-designate Idris I. In September, 1969, Idris was deposed when the royal government was overthrown in a military coup d'état and a republic established under the name Libyan Arab Republic (see LIBYA).

SÃO FRANCISCO, river of Brazil. It rises in the State of Minas Gerais, flows N., N.E., and S. to the Atlantic Ocean, and in its lower course separates the States of Bahia and Sergipe from the States of Pernambuco and Alagoas. About 1800 mi. long with a drainage area of 212,900 sq.mi., it is navigable in its middle course for 850 mi., but in its lower course navigation is interrupted at three points. These interruptions are at the rapids of Pirapórá, near the border of Bahia State, and where it breaks through the granite wall of the coast range to form the Paulo Afonso Falls; traffic is carried past this last point by a railroad line for 68 mi. The river flows into the Atlantic Ocean about 60 miles N.E. of Aracaju. A hydroelectric project utilizing the waters of the São Francisco R. and its tributaries was begun in 1949.

SÃO JOSÉ DO RIO PRÊTO, city of Brazil, in São Paulo State, in a pioneer settlement region about 100 miles N.W. of Ribeirão Preto. It is the trade center of an agricultural area producing cattle, coffee, rice, cotton, and vegetables. Industries in the city include rice milling, coffee processing, and the manufacture of dairy and meat products and leather goods. The city has colleges of dentistry and pharmacy. It was called Rio Preto until 1944. Pop. (1970 prelim.) 108,319.

SÃO LUÍS, or **SÃO LUÍS DO MARANHÃO**, city and port in Brazil, and capital of Maranhão State, on São Luís Island, between the mouths of the Mearim and the Itapicuru rivers, about 300 miles S.E. of Belém. Industries in the city include cotton mills, sugar refineries, fruit preserving, and weaving factories. The chief exports are cotton and sugar. The city, which was founded by the French in 1612, contains a cathedral and an episcopal palace in colonial style. Because of its strong cultural tradition, São Luís has been

SAÔNE

called the Athens of Brazil. Pop. (1970 prelim.) 167,329.

SAÔNE, river of France, an affluent of the Rhone R. It rises in Vosges Department, in the Faucigny Mts., flows sw. to Chalon-sur-Saône and then s., joining the Rhône at Lyon. The Saône R. is navigable for about 232 mi. of its approximate 268-mi. length. It is connected by canals with the Moselle, Marne, Yonne, and Loire rivers.

SÃO PAULO, city in Brazil, and capital of São Paulo State, about 300 miles sw. of Rio de Janeiro and about 49 miles n.w. of the port of Santos. São Paulo is on a plateau at an altitude of about 2700 ft. and is dissected by the Tietê R. The population of the city has increased to more than ten times what it was in 1920, and the city is now the largest in Brazil. São Paulo is also the financial center of Brazil and the clearing place for products, particularly coffee, brought from the interior and shipped from the port of Santos. Among the many industries in São Paulo are the production of automobiles, machinery, textiles, steel and wire products, chemicals, pottery and china, household utensils, furniture, shoes, and hosiery. The city has many skyscrapers in its business district, called the Triângulo, and is surrounded by residential districts on its outskirts, among them Jardim Europa, Jardim América, Cantareira, and Brooklyn. São Paulo is noted as an educational and cultural center. Among the more important institutions are the state-supported University of São Paulo (1934) and the privately-supported Catholic University (1946) and Mackenzie Institute (1870). Both the Modern Art Museum and the Municipal Library have outstanding collections. The Butantan Institute is internationally famous for its research on snakes and snakebites and for the production of vaccines and sera.

History. São Paulo was founded by Jesuit priests from Portugal in 1554, on the site of an Indian settlement. During the 16th and 17th centuries it was a base for expeditions sent from Portugal to obtain Indian slaves (see **SLAVERY**) and precious minerals. In 1712 São Paulo became a city, but its economy remained agrarian until the 19th century. On Sept. 7, 1822, São Paulo was the site of the proclamation of the independence of Brazil from Portugal. In 1867 a cable railroad was constructed, joining São Paulo to the port of Santos. Widespread coffee growing developed in São Paulo State beginning about 1885. As a result of improved transportation in the 20th century and an extensive development of the coffee trade, the city be-

came the commercial center of the region. Pop. (1970 prelim.) 5,186,752.

SÃO TOMÉ AND PRÍNCIPE, republic, comprising the islands of São Tomé, or São Thomé (Eng. *Saint Thomas*), and Príncipe, as well as the islands of Pedras Tinhosas and Rolas, situated off the w. coast of Africa in the Gulf of Guinea. The islands are volcanic and mountainous and heavily forested. The area is 372 sq.mi. The population was (official 1970 census) 74,541; the United Nations estimated (1975) 80,000. The chief port and administrative capital is São Tomé (pop., 1970 est., 7710).

The chief products are cacao, copra, coffee, palm oil, and cinchona. In the mid-1970's annual imports totaled about \$9,540,000, and exports were valued at about \$12,430,000. Recent annual budget figures set revenue at about \$6,600,000 and expenditures at about \$6,590,000. The islands were uninhabited until they were discovered in 1471 by the Portuguese, who established sugar plantations there.

SAP, liquid that circulates in plants, as distinguished from liquid plant products, such as turpentine and perfume oils, that must be extracted from plant tissues.

Sap rises from the root of the plant in the form of a solution, called crude sap, of material absorbed from the soil. Passing from cell to cell, mainly by osmosis through cell walls, the sap ascends to the leaves, where chemical changes take place under the influence of light. Chief among these changes are the absorption of carbon dioxide from the atmosphere and the formation of organic compounds; see **PHOTOSYNTHESIS**. When the sap, now called elaborated sap, descends, the organic compounds serve as a food supply for the plant. Elaborated sap contains sugars, amino acids (the chief components of protein), and hormones. The rate of sap circulation decreases in winter; an increased flow is one of the first signs of the approach of spring. Certain saps are useful to man. For example, the sap of the sugar maple tree may be converted into a sweetening agent or confection.

SAPONIFICATION. See **SOAP**.

SAPONINS, group of naturally occurring oily glycosides that foam freely when shaken with water. They occur in a wide variety of plants, including acacia (q.v.), soapwort, soaproot, California pigweed (see **AMARANTH**), and many others. Saponins have been, and sometimes still are, used as cleaning agents, and as foam producers, notably in fire extinguishing fluids. They have a bitter taste, and when ingested orally are practically nonpoisonous to warm-blooded animals. When injected directly into the blood-

stream, however, they are dangerous and quickly dissolve red blood cells. Hydrolysis (q.v.) of a saponin, brought about by acids or by enzymes (qq.v.), gives a sugar, often but not necessarily glucose, and a sapogenin, the latter being either a triterpene or a steroid. Some of the sugars and saponins are useful as raw materials for synthesis of steroid hormones (q.v.).

SAPPARE. See **CYANITE**.

SAPPHIRE, precious gemstone which occurs as a transparent, blue variety of the mineral corundum (q.v.). The ruby (q.v.) is a red variety of gem-quality corundum. Although the term sapphire is often applied to gem-quality varieties of a corundum of all other colors, the true sapphire is deep blue, the best tint being a corn-flower blue called Kashmir blue. Colorless, precious corundum is called white sapphire; yellow stones are called yellow or golden sapphire; and pale pink stones are called pink sapphire. The various colors in corundum are caused by small amounts of impurities, such as chromium, iron, or titanium, in the aluminum oxide of which the mineral is essentially composed. Excellent sapphires occur in alluvial deposits of sand and gravel in Ceylon. Some Ceylon sapphires exhibit asterism when cut cabochon, that is, in convex form and not faceted, and are highly valued star sapphires. Other important sources of the stones are Thailand, India, Afghanistan, China, the Ural Mountains, the Soviet Union, and Queensland, Australia. In the United States sapphires are found in the corundum deposits of Macon County, N.C., and near Helena, Mont. Sapphires are used, as are rubies, as jewels in watches and as hard bearings in scientific apparatus. Synthetic sapphires are produced in a manner similar to that used for synthetic rubies. See **GEM**; **GEM, ARTIFICIAL**.

SAPPHO, or **PSAPPHO** (fl. about 600 B.C.), Greek poet, born on the island of Lésvos (Lesbos), probably in Mitilíni (Mitylene). Her poetry was so renowned that the Greek philosopher Plato (q.v.) referred to her two centuries after her death as the tenth muse. Although the details of her life are unknown, it appears that she was of good family and was a contemporary of the Greek lyric poets Alcaeus (q.v.) and Stesichorus. According to tradition, unsupported by written evidence, Alcaeus was her lover. Another legend holds that because of unrequited love for the young boatman Phaon she leaped to her death from a steep rock, later called Lover's Leap, or Sappho's Leap, on the Greek island of Levkás. She had a daughter named Cleís, and two brothers, one of whom, Charaxus, fell in love with Doricha, a courtesan whom the Greek

historian Herodotus (q.v.) called Rhodopis. One of Sappho's poems is directed against her.

The fragmentary remains of Sappho's poems indicate that she taught her art to a group of maidens, to whom she was devotedly attached and whose bridal odes she composed when they left her to be married. Later writers of antiquity, commenting upon the group, accused Sappho of immorality and vice, from which arose the modern terms for female homosexuality, "lesbianism" and "sapphism".

Sappho wrote nine books of odes, epithalamia or wedding songs, elegies, and hymns, but the extant fragments are few. They include the *Ode to Aphrodite*, quoted by the Greek scholar Dionysius of Helicarnassus (d. about 7 B.C.); the famous ode quoted in *On the Sublime*, a treatise of literary criticism written during the 1st century A.D. by the Greek writer Longinus; and numerous short fragments cited by writers of antiquity to illustrate the Aeolic dialect, in which Sappho wrote; see **AEOLIANS**. Additional fragments have been recovered from Egyptian papyri in modern times.

Sappho's poems are marked by exquisite beauty of diction, perfect simplicity of form, and intensity of emotion. She invented the verse form known as Sapphics, a four-line stanza in which the first three lines are each eleven syllables long and the fourth is five syllables long. Many later Greek poets were influenced by Sappho, particularly Theocritus (q.v.).

See **GREEK LITERATURE: The Early Period: Lyric Poetry**; **LESBIAN POETS**; **ODE**.

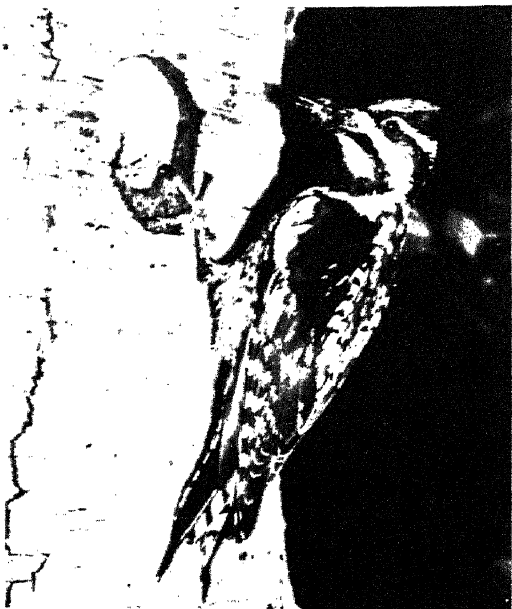
SAPPORO, city in Japan, and capital of Hokkaido Prefecture, on Hokkaido Island, 100 miles N.E. of Hakodate. Sapporo is the commercial and cultural center of Hokkaido. Principal industries in the city are breweries, sawmills, textile mills, and food-processing plants. Sapporo was founded as a planned city in 1871 and is the site of Hokkaido University, established in 1918. The Winter Olympic Games were held here in 1972. Pop. (1970), 1,010,123.

SAPROPHYTE (Gr. *sapro*, "rotten"; *phyton*, "plant"), term applied to plants which secure their nutriment from dead or decaying animal and vegetable matter, rather than by manufacturing their own food through the process of photosynthesis (q.v.). Saprophytes are important in recycling the remains of animals and plants which would otherwise accumulate; see **NITROGEN FIXATION**. The vast majority of the saprophytes are fungi or bacteria (qq.v.); the best known of the saprophytes are decay bacteria and mushrooms (q.v.). Many mosses and several ferns are saprophytes; see **FERN**.

SAPSUCKER

Saprophytic seed plants usually have symbiotic (see *Symbiosis*) fungus living in their roots or rhizomes; such fungus-root combinations are known as mycorrhizae. The fungus decomposes the organic matter around the mycorrhizae sufficiently to permit absorption thereof. Among the seed plants which are entirely saprophytic are the Indian pipe and certain orchids, especially the coralroots of the genus *Corallorhiza*.

SAPSUCKER, common name applied to two species of American woodpeckers belonging to the genus *Sphyrapicus*. The yellow-bellied sapsucker, *S. varius* breeds in the eastern United States and migrates southward and westward in



Yellow-bellied sapsucker, *Sphyrapicus varius*

Allan D. Cruickshank - National Audubon Society

winter. It feeds on the sap of trees, on insects, and on wild fruits. To obtain sap the bird drills many small holes in the bark of trees, sometimes causing serious damage to the trees. The adult bird is about 8½ in. long. The male has black and yellowish white irregular bars on the upper parts and pale yellow under parts. The crown and throat are deep red. The female has a white throat but is otherwise colored the same as the male. A race of this species found in the western U.S. has the crown, throat, and breast colored a deep, brilliant red. Williamson's sapsucker, *S. thyroideus*, found in western U.S., has jet black upper parts with two white stripes on the side of the head. The throat is red, the breast is black, and the abdomen is bright yellow. The female's plumage is colored in bars of white and

brown or black. The abdomen is yellow. See *WOODPECKER*.

SAPULPA, city in Oklahoma, and county seat of Creek Co., about 14 miles s.w. of Tulsa. It is the trade center for a farm and oil region. Manufactures include clothing, glass, and oil-field supplies. A United States government school for Indians is here. Nearby is the Heyburn Reservoir. Founded in 1888, the city was incorporated in 1898. Pop. (1960) 14,282; (1970) 15,159.

SARACENS, name variously employed to designate the Muslims of Syria and Palestine, the Arabs generally, or the Arab-Berber races of northern Africa. At a later date it was employed as a synonym for all peoples against whom crusades (q.v.) were preached, particularly those of the Turkish Empire. In the hundred years following the Hegira (q.v.), or the flight from Mecca to Medina, of the prophet Muhammad (q.v.) in 622 A.D., a Saracen empire was established that extended from Turkestan to the Atlantic Ocean. Muhammad made himself master of Mecca in 629, and the first caliphs, Abu-Bakr and Omar I (qq.v.), between 632 and 641, conquered Syria, Palestine, Persia, and Egypt; see *CALIPH*. By 709 the Saracens had extended their sway over northern Africa to beyond the Strait of Gibraltar. They then, in 711, crossed over to Spain, nearly the whole of which they subjected; see *SPAIN: History*. From Spain they poured into Gaul, where their progress was arrested by the Frankish leader Charles Martel (q.v.), near Poitiers (q.v.) in France, in 732. Sicily was conquered by the Saracens between 827 and 878; see *SICILY: History*. Early in the 10th century they extended their incursions far into the Burgundian territories; see *FRANCE: History*. The disruption of the Saracen empire began about the middle of the 8th century, when the western portion became a separate state, with the Spanish city of Córdoba as its capital. See *ISLAM: History*; *MOORS*.

SARAGOSSA (Sp. *Zaragoza*), city in Spain, and capital of Saragossa Province, on the Ebro R., about 170 miles N.E. of Madrid. The city is an important industrial and commercial center. Principal manufactures are textiles, agricultural machinery, glass, cement, and refined sugar. Saragossa is famed as the site of many architectural landmarks. Most notable are the La Seo Cathedral, built between the 12th and the 16th centuries; the 17th-century El Pilar Cathedral, containing a chapel decorated with frescoes by Spanish masters; the Castillo de la Aljafería, a citadel built originally by the Moors (q.v.) and later the royal residence of the former kingdom of Aragón (q.v.); and the 16th-century Lonja, or

Exchange, a richly decorated Renaissance building. The city is also the site of the University of Saragossa, founded in 1542.

History. The ancient settlement Salduba originally occupied the site of present-day Saragossa. Salduba was captured in the 1st century B.C. by the Romans, who renamed it Caesaraugusta; the present name is a corruption. After the 6th century A.D., the city was ruled successively by the Suevi (q.v.), the Visigoths (see GOTHs), and the Moors. From the 12th century to the latter half of the 15th century, it was the capital of Aragón. Saragossa declined in importance after the unification of the kingdoms of Aragón and Castile in 1469. The city became renowned throughout Europe, however, during the Peninsular War (1808–14) when its citizens displayed extreme heroism against a besieging French army in 1808–09. See *SPAIN: History*. Pop. (1970) 479,845.

SARAH. See ABRAHAM.

SARAH LAWRENCE COLLEGE, privately controlled coeducational nonsectarian college of liberal arts, located in Bronxville, N.Y. The college was founded in 1926 and opened in 1928. It was one of the first colleges to offer academic programs involving independent study. Students plan their own programs of study in consultation with faculty advisers. Study includes small, seminar-type classes with an emphasis on discussions, independent study, and tutorial work. The center for continuing education was one of the first undergraduate degree programs designed to meet the needs of women with family commitments, and a women's studies program was begun in 1973 with a grant from the Rockefeller Foundation (q.v.). Degrees offered are B.A., M.A., M.S., M.F.A., master of professional studies, and master of science in education. In 1973 the library contained 250,000 volumes, enrollment totaled 945 students, and the faculty totaled 143.

SARAJEVO, or SARAYEVO, city in Yugoslavia, and capital of the Socialist Republic of Bosnia and Hercegovina, on the Miljacka R., 122 miles s.w. of Belgrade. Sarajevo is an important commercial and cultural center. The principal manufactures in the city include carpets, silk fabrics, jewelry, tobacco goods, and machine tools. It is the site of several educational and cultural institutions, including the Bosnian and Hercegovinian Country Museum (1888) and the University of Sarajevo (1946).

History. The site of Sarajevo was founded in the 14th century. From 1429 to 1878 it was part of the Ottoman Empire (q.v.), and numerous examples of Turkish architecture still remain in the city. It then came under the rule of Austria-

Hungary (q.v.). Sarajevo was the scene of the assassination, on June 28, 1914, of Francis Ferdinand (q.v.), Archduke of Austria. After World War I the city became part of Yugoslavia. Pop. (1971) 244,045.

SARANAC LAKE, village of New York, in Franklin and Essex counties, in the Adirondack Mts., near the head of Lower Saranac Lake, 50 miles s.w. of Malone. It is a noted tourist and health resort at an altitude of 1540 ft. Tourism is the major industry but the village also has small establishments producing wood products and clothing. Several medical institutions concerned with respiratory diseases were situated near Saranac Lake, including the Trudeau Foundation Research Laboratory. The Scottish writer Robert Louis (Balfour) Stevenson (q.v.) resided here (1887–88) while receiving treatment for tuberculosis. Pop. (1960) 6421; (1970) 6086.

SARAPIS. See SERAPIS.

SARASATE Y NAVASCUÉS, Pablo de, real name MARTÍN MELITÓN SARASATE Y NAVASCUÉS (1844–1908), Spanish violinist and composer, born in Pamplona. He studied music in France at the Paris Conservatory. Sarasate devoted most of his career to making concert tours in Europe, the Americas, and the Orient. Several works were composed for him, notably *Introduction et Rondo Capriccioso* (1870) by the French composer (Charles) Camille Saint-Saëns (q.v.) and *Symphonie Espagnole* ("Spanish Symphony", 1873) by the French composer Édouard Lalo (1823–92). Among Sarasate's own compositions is the popular *Zigeunerweisen* ("Gypsy Melodies", 1863).

SARASOTA, city in Florida, and county seat of Sarasota Co., on Sarasota Bay of the Gulf of Mexico, 45 miles s. of Tampa. The area raises and ships citrus fruits, cattle, and vegetables, and the city manufactures machine and metal products, optical equipment, boats, concrete, electrical equipment, wood products, paint, and feed. A major Florida West Coast fishing, bathing, and retirement resort, the city includes several residential islands in the bay. Until the 1960's it was the winter headquarters of the Ringling Brothers–Barnum and Bailey Circus since 1929 and features the Circus Museum and Hall of Fame, the John and Mable Ringling Museum of Art, the Lido Beach Casino, the "Cars of Yesterday" Museum, a reptile farm, jungle gardens, a zoo, and the Venetian-Gothic Ringling residence. The city is the site of New College (1960) and winter home of the Chicago (Ill.) White Sox baseball team of the American League. Of interest is the annual Sara de Soto Pageant. Although settled earlier, Sarasota developed after the

SARATOGA

San Jose, California, in 1864 and became the city of Saratoga in 1921. Pop. (1960) 34,983; (1970) 41,107.

SARATOGA, city of California, in Santa Clara Co., in the piedmont area of the Santa Cruz Mts., about 6 miles W. of San Jose. Primarily residential, the city is in a fruit-growing region. A number of fruit-drying equipment are manufactured. Saratoga was incorporated in 1956. Pop. (1960) 14,661; (1970) 27,110.

SARATOGA, BATTLES OF, two engagements fought in 1777 between the Americans and the British during the American Revolution (q.v.). The first battle took place on Sept. 19, 1777, when a British force under General John Burgoyne fought an indecisive engagement with an American army led by General Horatio Gates (q.v.) at a place called Freeman's Farm, on Bemis Heights, near Saratoga, N.Y.

The second engagement occurred on Oct. 7, 1777. The British, commanded by Burgoyne, attacked the American position on Bemis Heights but were driven back by the Americans under General Benedict Arnold (q.v.). Burgoyne was forced to retreat and entrenched his forces near Saratoga. He was rapidly surrounded by American troops, however, and on Oct. 17 he surrendered to Gates. The Battles of Saratoga, the first major American victories, marked the turning point of the war.

SARATOGA SPRINGS, city of New York, in Saratoga Co., near Saratoga Lake, 30 miles N. of Albany. Saratoga Springs has been a noted health and tourist resort since the early 19th century. Several medicinal mineral springs are at the city, which is also famous for the horse races held there annually during August. The principal industries are the bottling of mineral water and the manufacturing of textiles and electronic equipment. The city is the site of Skidmore College, founded in 1911, and of the Saratoga Performing Arts Center, which was opened in 1967 and has annual summer performances by the Philadelphia Symphony Orchestra and the New York City Ballet. Settled in 1775, Saratoga Springs was incorporated as a city in 1915. Pop. (1960) 16,630; (1970) 18,845.

SARATOV, city of the Soviet Union, in the Russian S.F.S.R., and capital of Saratov Oblast, on the Volga R., 220 miles N. of Volgograd. It is a major river port in a region producing grain, oil, and natural gas; a gas pipeline runs from Saratov to Moscow. Major industries at Saratov include the manufacture of agricultural machinery, textiles, chemicals, and flour. Several cultural and educational institutions are located in the city, including the Saratov N.G. Chernyshevsky State

University, founded in 1909, and a state art museum. Saratov was founded as a fortress in 1590. It became an important shipping point for oil and grain during the 19th century, and the rapid industrial growth of the city began in the early 20th century. Pop. (1971 est.) 773,000.

SARAWAK, State within Malaysia (q.v.), situated in the N.W. part of the island of Borneo (q.v.). The population is composed chiefly of Malays, Dayaks (q.v.), and Chinese. The majority of the people are Christians, although a large Muslim population exists. The official languages are Malay and English. The capital is Kuching. Principal products include rubber, petroleum, timber, pepper, sago, oil, rice, gold, and bauxite; coal resources exist. The state has no railroads, but some 1000 mi. of roads are in use.

Government of the present territory was obtained by the British soldier Sir James Brooke (q.v.) from the sultan of Brunei in 1841. In 1888 Sarawak was placed under British protection, and was occupied by the Japanese in December, 1941. In 1946 the rajah ceded the country to Great Britain, of which Sarawak became a crown colony. Sarawak joined with the Federation of Malaya, Singapore, and Sabah (formerly British North Borneo) to form the independent Federation of Malaysia in 1963 (now Malaysia). The head of state is a governor appointed by the British sovereign and the Malaysian head of state. Area, about 50,000 sq.mi.; pop. (1973 est.) 968,997.

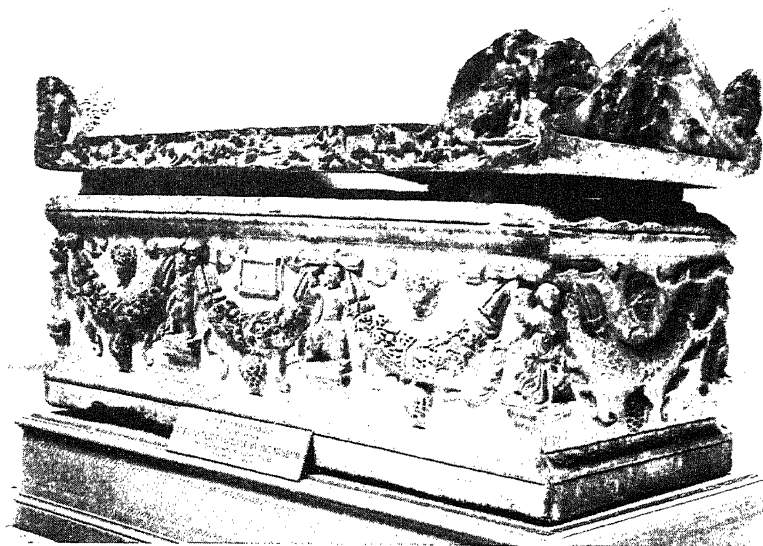
SARAYEVO. See SARAJEVO.

SARAZEN, Gene (1901–), American professional golf player, born in Harrison, N.Y. Among the many golf championships he won were the United States Open (1922 and 1932), the Professional Golfers' Association of America (1922, 1923, and 1933), the Metropolitan Open (1925), the Mexican Open (1929), the British Open (1932), the Master's Open (1935), and the Australian Open (1936). He was a member of the U.S. Ryder Cup team (1927, 1929, 1931, 1935, and 1937), which won the cup four out of five times. In 1941 Sarazen was elected an original member of the Professional Golf Association Hall of Fame. In 1954 he was the victor in the first International Senior's Championship match, which was limited to professional golfers over the age of fifty.

SARCOMA. See CANCER.

SARCOPHAGUS (Gr. "flesh eating"), any stone receptacle for a dead body, usually placed above ground. The name comes from the limestone used by the ancient Greeks of Asia Minor for coffins. These coffins allegedly consumed the whole body, with the exception of the

Ancient Roman sarcophagus.
Metropolitan Museum of Art



teeth, within forty days. The oldest-known sarcophagi are those of ancient Egypt. The Egyptian sarcophagus was often carved in the form of the enclosed mummy. The sarcophagi of the period of the Roman Empire frequently had elaborately carved mythological scenes on them. In early Christian times sarcophagi depicted Biblical scenes. See CHRISTIAN ART, EARLY: *Sculpture*; TOMB. See also MORTUARY CUSTOMS.

SARDANAPALUS. See ASHURBANIPAL.

SARDINE. See HERRING; PILCHARD.

SARDINIA, island of Italy, in the Mediterranean Sea, together with the surrounding small islands constitutes Sardinia Region. It is about 135 miles w. of the Tiber R. mouth, and immediately s. of Corsica, being separated from it by the Strait of Bonifacio, 7.5 mi. wide. The second largest island in the Mediterranean, Sardinia is about 166 mi. long and about 75 mi. wide. The

surface is generally mountainous. The highest point reaches 6017 ft. in Punta La Marmora. The best farmland is in the Campidano, a plain in the s.w. part of the island. Livestock raising and farming are the chief occupations; grain, olives, grapes, and tobacco are grown. Other important industries include fishing and the mining of lead, zinc, copper, and salt.

The Carthaginians founded trading stations in Sardinia. Rome seized it in 238 B.C. After the fall of the Roman Empire Sardinia was overrun by Vandals and then passed to the Byzantines in the 6th century A.D. From the 8th to the 11th century Sardinia was incessantly harassed by the Saracens. From the 11th to the 14th century the Pisans and Genoese fought each other for possession of the island. In the 14th century the

The Church of Porto Cervo, in Sardinia.

UPI



SARDINIA, KINGDOM OF

place and claimed the overlordship, gave Sardinia to the king of Aragón. The Aragónese and their sovereign successors, the Spanish, ruled Sardinia until the Treaty of Utrecht in 1713, which gave it to Austria. In 1720 it came under the rule of the house of Savoy; see SAVOY, HOUSE OF. United with Savoy, Piedmont, and Nice (qq.v.), Sardinia became the Kingdom of Sardinia. In 1861 Sardinia became part of the Kingdom of Italy. Area of region 9302 sq.mi.; pop. (1971), 1,468,737.

SARDINIA, KINGDOM OF, in 18th- and 19th-century Europe, an Italian kingdom formed by the union of the kingdom of Piedmont and the island of Sardinia (qq.v.). By the Treaty of London (1720) Austria ceded the island of Sardinia to the House of Savoy, which over the next century and a half enlarged the kingdom, acquiring numerous mainland city-states and regions; see ITALY: *History: The Rise of the City-States*. The mainland part of the kingdom of Sardinia originally comprised Savoy, Piedmont, and Nice (qq.v.). In 1734 King Charles Emmanuel III (1701-73) acquired Novara (q.v.) and Tortona for Sardinia and, in 1748, Vigevaresco. Throughout the century, social and economic conditions were improved and the settlement of Piedmontese, Corsicans, and Ligurians encouraged to cement ties with the mainland. The power of Sardinia diminished following the Seven Years' War and the French Revolution (qq.v.), but in 1815 the kingdom absorbed Liguria and Genoa (qq.v.). Under the program of democratization introduced by King Charles Albert (1798-1849), who came to the throne in 1831, feudal dues were essentially abolished, the laws derived partially from the Napoleonic Code (see CODE NAPOLEON), were codified and elementary schools were put under state control rather than the church.

Sardinia exercised vital leadership for Italians during the Risorgimento, the 19th-century movement for Italian unity and independence; see ITALY: *History: Risorgimento*. After the Revolution of 1848 (q.v.) on the mainland of Europe, the Sardinians received a constitution. In 1859-60 the kingdom annexed Lombardy, Modena, Parma, and the Papal States except for Latium and Rome (qq.v.). Upon the creation of the kingdom of Italy in 1861, the kingdom of Sardinia came to an end.

See SAVOY, HOUSE OF.

SARDIS or **SARDES**, ancient city of Asia Minor (now in Turkey), and capital of Lydia, at the N. base of Mt. Tmolus (now Boz Dağ), on the Pactolus R. (now Baguli R.), about 50 miles N.E. of Smyrna (now Izmir, Turkey). The city attained

its greatest prosperity during the reign of Croesus (q.v.), King of Lydia, and after his overthrow in 546 B.C. by Cyrus the Great (q.v.), King of Persia, it became the western capital of the Persian Empire. Alexander III (q.v.), King of Macedonia, called the Great, conquered Lydia in 334 B.C.; upon his death eleven years later, the city passed to his successor Antiochus I, King of Syria (see under ANTIOCHUS). Subsequently it came under Roman control. Sardis was an early seat of the Christian religion and the site of one of the Seven Churches of Asia mentioned in the Bible (Rev. 3:1). The town was destroyed by the Mongol conqueror Tamerlane (q.v.) in 1402. Archaeological excavations uncovered the site of the ancient city in 1958.

SARDONYX, fibrous, chalcedonic mineral, a banded variety of cryptocrystalline quartz, that is similar to onyx and agate (qq.v.). Sardonyx consists of parallel layers of clear red or reddish brown carnelian (q.v.), or sard, alternating with layers of white chalcedony (q.v.). The reddish color is caused by impurities of iron oxide. As a gem (q.v.), sardonyx is cut so that the layers are visible on the faces; see GEM CUTTING. It is the birthstone (q.v.) for the month of August; it was valued by the Romans and other ancient peoples. See CAMEO; GEM ENGRAVING.

SARDOU, Victorien (1831-1908), French dramatist, born in Paris. After having been educated by his father, who was a schoolteacher, Sardou studied medicine for a brief time at a Paris hospital. He turned to writing and quickly gained enormous popularity. Today his works are admired much less than they were in his lifetime. He wrote about seventy plays, including *Madame Sans-Gêne* (1893; Eng. trans., *Madame Devil-May-Care*, 1901) and *Robespierre* (1899; Eng. trans., 1899). For the French actress Sarah Bernhardt (q.v.) he wrote the well-known *Fedora* (1882; Eng. trans., 1883) and *La Tosca* (1887; Eng. trans., 1925).

SARGASSO SEA. See ATLANTIC OCEAN.

SARGENT, John Singer (1856-1925), American painter, born in Florence, Italy, of American parents. He studied art in Italy, France, and Germany, receiving his formal art education at the École des Beaux-Arts and in the Paris studio of the noted French portraitist Carolus Duran (q.v.). He spent most of his adult life in England, maintaining a studio there for more than thirty years and visiting America only on short trips.

Sargent is known for his glamorous portraits of eminent or socially prominent people of the period. Criticized for what some believed to be a superficial brilliance, the portraits fell into disfavor after his death. Since that time, however,



"Madame X" by John Singer Sargent.

Metropolitan Museum of Art

these same canvases have been acknowledged for their naturalism and superb technical skill. About 1907 Sargent tired of portrait painting and, turning to other subjects, accepted few commissions. He then worked chiefly in watercolor, his style in this medium being notably impressionistic. Among his more famous works are "El Jaleo" (1882, Gardner Museum, Boston), "Madame X" (1884, Metropolitan Museum of Art, New York City), "The Wyndham Sisters" (1900, Metropolitan Museum of Art), and "Boats at Anchor" (1917, Worcester Art Museum, Worcester, Mass.).

SARGODHA, city of Pakistan, in West Pakistan Province, in the Doab region of the Punjab on a branch of the Lower Jhelum Canal, 105 miles N.W. of Lahore. The city is a rail junction and trade center for an irrigated area producing grains, cotton, citrus fruits, and oilseeds. Industries include engineering plants, a steel mill,

and cotton, rice, flour, and oilseed mills. As headquarters of the canal colony, the city grew quickly in the early 20th century. Pop. (1972 est.) 203,000.

SARGON. See ASSYRIA.

SARK. See CHANNEL ISLANDS.

SARMATIANS, ancient nomadic and pastoral people, speaking an Indo-Iranian language (see INDO-IRANIAN LANGUAGES), who, in the 5th century B.C., according to accounts by the contemporary Greek historian Herodotus (q.v.), lived between the Caspian Sea, the Don R., and the Sea of Azov. By the 3rd century B.C. they had subdued the Scythians (q.v.) of the great plains north of the Black Sea, and their territory extended from the Baltic Sea to the Black Sea and from the Vistula R. to the Volga R. They remained dominant in this area until they were overpowered by the Goths from the west in the 3rd century A.D. and by the Huns (qq.v.) from Asia in the 4th century. Among the Sarmatian tribes were the Alans (q.v.), Roxolani, and Jazyges.

SARNIA, city and port of Canada, in Ontario Province, and county seat of Lambton Co., at the mouth of the Saint Clair R., about 70 miles W. of London. A railway tunnel beneath the St. Clair and a highway bridge connect Sarnia with Port Huron, Mich. Sarnia is a leading oil-refining center in Canada. It is the southern terminus of the oil and gas pipeline from Alberta; in the mid-1970's an oil pipeline from Sarnia to Montréal was put in service. Pop. (1976) 55,576.

SARNOFF, David (1891–1971), Russian-born American broadcasting executive, born in Uzlian, near Minsk in what is now the White Russian S.S.R. With his parents he emigrated (1900) to New York City, where he was educated in the public schools. In 1906 he was employed as an office boy by the Marconi Wireless Telegraph Company and soon thereafter became a telegrapher. He advanced rapidly and in 1915 presented to the company his idea for a radio receiving set. In 1919 he became commercial manager of the Radio Corporation of America (R.C.A.), when that company absorbed the Marconi company, and in 1926 he organized the National Broadcasting Company, the first permanent broadcasting network, as part of R.C.A. He became president of R.C.A. in 1930, serving until 1947, when he became chairman of the board. He retired in 1969, retaining the title of honorary chairman. Sarnoff sponsored many innovations in the field of radio and television. During World War II he served as chief of communications under General Dwight David Eisenhower (q.v.), later United States President,

and in 1944 he rose to the rank of brigadier general. He is the author of *Looking Ahead* (1968). He was succeeded as chairman of the board by his son Robert W. Sarnoff (1918–).

SAROYAN, William (1908–), American writer, born in Fresno, Calif., of Armenian parents, and educated in the Fresno public schools. His first published work was the short story "Daring Young Man on the Flying Trapeze", which appeared in *Story Magazine* in 1934. The same year he published his first volume of short stories, it included his first story and had the same title. His other writings include the plays *My Heart's in the Highlands* (1939) and *The Time of Your Life* (1939), for which he was awarded a Pulitzer Prize (1940), which he refused, and the collection of three long and nineteen very short plays *The Dogs, or The Paris Comedy* (1969); the collections of short stories *My Name is Aram* (1940) and *Letters from 74 Rue Tairbout* (1969); the novels *The Human Comedy* (1942) and *Boys and Girls Together* (1963); the autobiography *Here Comes, There Goes, You Know Who* (1961) and the journal *Days of Life and Death and Escape to the Moon* (1970). Saroyan most often writes about common people, and his work has a wondering, almost childlike, naïveté. In the early 1960's he left California and moved to France.

SARRACENIA. See CARNIVOROUS PLANTS.

SARSAPARILLA. See SMILAX.

SARTO, Andrea del (1486–1531), Florentine painter of the High Renaissance, born Andrea Domenico d'Agnolo di Francesco di Luca Vanucchi in Florence. He studied painting under the Italian Renaissance painter Piero di Cosimo (q.v.), and from about 1508 to about 1512 collaborated with the Florentine painter Franciabigio (1482–1525). At about the same time, he was employed by the Servites, a religious brotherhood, to execute fresco decorations in their Church of the Sant' Annunziata at Florence. By 1510 he completed five scenes depicting events in the life of Filippo Benizzi (1223–85), founder of the Servite order. These works were widely acclaimed as examples of faultless painting in drawing, color, and light and shade. Many commissions followed, including a series of frescoes of the life of Saint John the Baptist in the cloister of the Scalzi in Florence.

Del Sarto's reputation became international, and in 1518 he was summoned to the court of Francis I (q.v.), King of France, who entrusted him with money to purchase works of art in Italy. He returned to Florence in 1519, used the money for his own purposes, and remained in Florence, completing the fresco series in the



"Madonna and Child with Saint Elizabeth" (1515–1519) by Andrea del Sarto.
National Gallery, London

cloister of the Scalzi. In 1525 he painted in the cloister of the Servite church the "Madonna del Sacco", which is generally considered his masterpiece. Subsequently, he executed his last major work in fresco, the "Last Supper" (1527) in the refectory of the convent of San Salvi near Florence.

Del Sarto also painted numerous easel paintings, including portraits, such as those of his wife and of himself in the Pitti Palace, Florence; and religious subjects, such as the "Madonna of the Harpies" (1517, Uffizi Gallery, Florence). Among his other noted works are *Pietà* (1524, Pitti Palace, Florence) and "Assumption" (1530, Pitti Palace). The Italian architect and painter Giorgio Vasari (q.v.) was his pupil.

SARTRE, Jean-Paul (1905–), French philosopher, dramatist, novelist, and political journalist, born in Paris, and educated at the École Normale Supérieure, in Paris, the University of Fribourg, and the French Institute in Berlin, Germany. He taught philosophy at various lycées from 1929 until the outbreak of World War II, when he was called into military service. In 1940–41 he was imprisoned by the Germans; after his release he taught in Neuilly and later in Paris, and was active in the French Resistance. The German authorities, unaware of his underground activities, permitted the production of his anti-authoritarian play *Les Mouches* (1943; Eng. trans., *The Flies*, 1946) and the publication

of his major philosophical work *L'Être et le Néant* (1943; Eng. trans., *Being and Nothingness*, 1953). Sartre gave up teaching in 1945 and founded the political and literary magazine *Les Temps Modernes*, of which he was thereafter editor in chief. He was active after 1947 as an independent Socialist, critical of both the Soviet Union and the United States in the so-called cold war. Later he supported the Soviet position, but he frequently criticized its policies. Most of his writing of the 1950's deals with literary and political problems. Sartre rejected the 1964 Nobel Prize in literature, explaining that acceptance would compromise his integrity as a writer.

Sartre's philosophical works combine the so-called phenomenology of the German philosopher Edmund Husserl (see PHENOMENOLOGY) the metaphysics of German philosophers Georg Wilhelm Friedrich Hegel and Martin Heidegger, and the social theory of the German revolutionary Karl Marx (q.v.) into a single view called existentialism (q.v.). This view, which relates technical philosophy to life, literature, psychology, and political action, stimulated so much popular interest that existentialism became a worldwide movement.

Being and Nothingness. In his earlier major philosophical work *Being and Nothingness*, Sartre conceived man as a being who creates his own world by rebelling against authority and by accepting personal responsibility for his actions unaided by society, traditional morality, or religious faith. Distinguishing between human existence and the nonhuman world, he maintained that human existence is characterized by

nothingness, that is, the capacity to negate and rebel. His theory of existential psychoanalysis asserted the inescapable responsibility of each individual for his decisions and made the recognition of one's absolute freedom of choice the necessary condition for authentic human existence. His plays and novels express the belief that freedom and acceptance of personal responsibility are the main values in life and that the individual must rely on his creative powers rather than on social or religious authority.

Critique of Dialectical Reason. In his later philosophical work *The Critique of Dialectical Reason* (1960), Sartre's emphasis shifted from existentialist freedom and subjectivity to Marxist social determinism. Sartre argued that the influence of modern society over the individual is so great as to produce serialization, by which he meant loss of self. Individual power and freedom can only be regained through group revolutionary action. Despite this exhortation to revolutionary political activity, Sartre himself did not join the Communist Party, thus retaining the freedom to criticize the Soviet invasions of Hungary and Czechoslovakia, as well as Western imperialism.

Other Writings. Sartre's other works include the novels *La Nausée* (1938; Eng. trans., *Nausea*, 1949) and the unfinished series *Les Chemins de la Liberté* ("The Roads of Liberty"), comprising *L'Âge de Raison* (1945; Eng. trans., *The Age of Reason*, 1947), *Le Sursis* (1945; Eng. trans., *The Reprieve*, 1947), and *La Mort dans L'Âme* (1949; Eng. trans., *Troubled Sleep*, 1951); the biography *Saint Genet, Comédien et Martyr* (1952; Eng. trans., *Saint Genet, Actor and Martyr*, 1952); the plays *Huis Clos* (1944; Eng. trans., *No Exit*, 1946), *La Putain Respectueuse* (1946; Eng. trans., *The Respectful Prostitute*, 1947), and *Les Sequestrés d'Altona* (1959; Eng. trans., *The Condemned of Altona*, 1961); the autobiographical *Les Mots* (1964; Eng. trans., *The Words*, 1964); and his biography of the French author Gustave Flaubert (q.v.), the first three volumes of which appeared between 1970 and 1973. R.A.

SASEBO, city port, and naval base of Japan, in the Nagasaki Prefecture, on the N.W. coast of Kyushu Island, about 32 miles N. of the city of Nagasaki. Industries include shipbuilding and metallurgy. Noted for its deep natural harbor, Sasebo became an arsenal and naval base in 1886 and later served as one of Japan's great modern naval bases. The city was severely damaged during World War II. The naval base is currently used by the United States Navy by agreement with the Japanese government. Pop. (1970) 248,000.

Jean-Paul Sartre

UPI



SASKATCHEWAN

SASKATCHEWAN, one of the three Prairie Provinces of Canada, situated in the west-central part of the country, and bounded on the N. by the Northwest Territories, on the E. by Manitoba, on the S. by the States of Montana and North Dakota, and on the W. by Alberta. Saskatchewan occupies an area of 251,700 sq.mi., including 31,518 sq.mi. of water surface. The province extends 761 mi. in a N. and S. direction; in an E. and W. direction it ranges from 277 mi. in the N. to 393 mi. in the S.

THE LAND

Saskatchewan consists, in almost equal parts, of two main natural regions, namely, a section of the North American prairie, or grasslands, located in the S., and a portion of the forested northland of Canada, situated in the N. The topography of both regions is marked by vast stretches of comparatively level land broken by a few ranges of low hills, by a considerable amount of rolling land, particularly in the S.W. area, and by valleys cut by rivers and streams. The lowest altitude (700 ft.) is at Lake Athabasca (q.v.), and the highest is in the Cypress Hills (4546 ft.); the province slopes downward from the S.W. to the E. and N.

Rivers and Lakes. The eastward-flowing North Saskatchewan and South Saskatchewan rivers, both of which rise in the Rocky Mts., join near Prince Albert to form the Saskatchewan River (q.v.), which flows N.E. and enters Manitoba. The major rivers of the S. include the Frenchman R., which flows S.E. into Montana and empties into a tributary of the Missouri R.; and the Assiniboine (q.v.), Souris, and Qu'Appelle rivers, tributaries of the Red R. The valleys of all four rivers are steep-sided and narrow; the volume of water is small. Flowing E. through the heart of the forested N. area, between the North Saskatchewan and lat. 60° N., are the Churchill River and its tributaries. In this area are numerous lakes; the largest is Reindeer Lake (q.v.; 2568 sq.mi., of which 2197 sq.mi. are in Saskatchewan). Other lakes together with their areas are Athabasca (2124 sq.mi., within Saskatchewan), Wollaston (1035 sq.mi.), Lac La Ronge (546 sq.mi.), Cree (554 sq.mi.), and Peter Pond (300 sq.mi.).

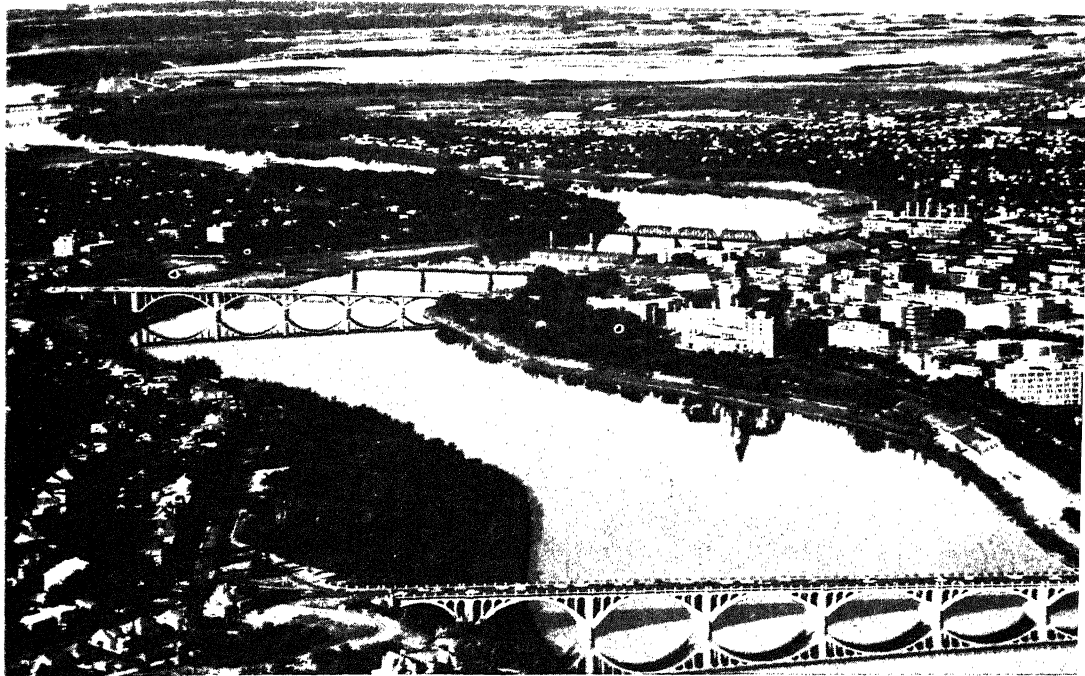
Climate. Five climatic regions span the province from S.W. to N.E., namely, the semiarid, sub-humid prairie, subboreal, boreal, and subarctic regions. Extreme variations in temperature are characteristic of most of the province; summer temperatures above 100° F. and winter readings below -50° F. have been recorded. In the N., average temperatures range between -15° F. and -20° F. in January and between 60° F. and

65° F. in July; in the S., the temperature ranges between -5° F. and 10° F. in January and 65° F. and 70° F. in July. The average frost-free period varies from less than 70 days in the far N. to about 120 days in the S.

Annual precipitation varies in the S. between 14 and 16 in., about half of which falls usually in June, July, and August. Precipitation is slightly higher in the central part of the N. forest region and lower in the far N.

Plants. Saskatchewan possesses a series of vegetation belts that extend from the S.W. to the N.E. In the semiarid, treeless S.W., June grass, blue gamma grass, spear grass, pasture sage, and prickly-pear cactus are characteristic species. Farther N. is found a wide belt of mixed-grass prairie; this region contains the same vegetation as the S.E., along with taller grasses and, in hollows and river valleys, small groves of poplar, willow, and other shrubs. Beyond this prairie belt is the park, or aspen-grove, belt, in which tall grasses and groves of aspen poplar and black poplar are found, as well as willow, dogwood, rose, saskatoon berry, and other plants and trees. Many broad-leaved plants grow in the park belt. In the valleys of the S.E. section are found Manitoba maple, American elm, green ash, birch, and bur oak. Farther to the N. is a mixed-wood belt varying in width from 125 to 150 mi.; in addition to the deciduous trees the belt contains such coniferous trees as white and black spruce, jack pine, and tamarack and a variety of shrubs, including blueberry, Labrador tea, hazel, and cranberry. The coniferous forest proper begins at the edge of the Canadian Shield (q.v.); for the most part, the coniferous trees of the region are smaller than those of the mixed-wood belt. The coniferous zone merges in the far N.E. with the subarctic region, where trees and plants are relatively scarce. In all, 18 percent of the land area of the province is classified as forested.

Animals. The character and distribution of wildlife vary with the region. In the subarctic forests are found the caribou and the timber wolf; in the coniferous-forest area are the beaver, bear, fox, mink, otter, moose, elk, muskrat, fisher, marten, weasel, and lynx; in the park belt are the deer, rabbit, and squirrel; and in the grasslands are the pronghorn antelope, jack rabbit, gopher, and coyote. The lakes of the province, particularly those in the N., teem with such fish as the pickerel, pike, lake trout, whitefish, and tullibee. Bird species include the Canada goose, prairie chicken, Hungarian partridge, ruffed grouse, white pelican, loon, many varieties of duck, and many smaller species.



Aerial view of Saskatoon, on the South Saskatchewan River.
National Film Board of Canada

Parks and Other Places of Interest. Saskatchewan has a national park, Prince Albert National Park; two national historic parks, Fort Battleford and Fort Walsh; a national historic site, Batoche; and fifteen provincial parks, of which Cypress Hills, Moose Mountain, Greenwater Lake, and Duck Mountain parks are operated as summer resorts with chalet, lodge, and cabin accommodations. Most of the provincial parks provide camping, picnicking, and water-sports facilities. In addition, three wilderness parks, La Ronge, Nipawin, and Meadow Lake in the N., offer canoe routes and fly-in fishing and hunting camps. The total area of the provincial parks is 1821 sq.mi. Fort Battleford National Historic Park is the site of an important Northwest Mounted Police post of pioneer times. Batoche Rectory is the only remaining building of those that stood on the battlefield of the Northwest Rebellion of 1885.

THE PEOPLE

According to the latest official census (1976), the population of Saskatchewan was 921,323. About 55.2 percent of the population lives in urban communities of more than 1000 persons. More than 98 percent is in the s. half of the province.

The national backgrounds of the population are varied; the principal groupings are British (42 percent), German (19 percent), Ukrainian, Polish, and Russian (13 percent), Scandinavian (6 percent), and French (6 percent). The province has more than 40,400 Native Indians, mostly living on reserves. Eighty-four percent of the population is Canadian-born.

The cities, towns, and villages of Saskatchewan are predominantly commercial centers. Regina (q.v.), the provincial capital, is the largest city (pop., 1976, 149,593). Other important cities are Saskatoon (133,750), Moose Jaw (32,581), and Prince Albert (28,631) (qq.v.).

Education and Cultural Facilities. School attendance is free and compulsory for children between the ages of eight and sixteen. Residents have the option of applying their school taxes to the support of either private schools with religious affiliations or nondenominational public schools.

ELEMENTARY AND SECONDARY SCHOOLS. In the mid-1970's Saskatchewan had 990 public, Federal, and private schools (except private kindergartens), which were attended annually by 219,377 students; full-time teachers numbered 10,786. The province also has a school for the deaf, which is attended by 150 students each year. Vocational courses are offered in the high schools, and the province maintains a correspondence school for pupils in remote areas.

COLLEGES AND UNIVERSITIES. The province has two universities and fifteen community colleges, which were attended by a total of more than 100,000 students in the late 1970's. The degree-granting institution of higher education is the University of Saskatchewan at Saskatoon and its affiliate, Saint Thomas More College, Saskatoon; and the University of Regina, with Campion College, Regina, as an affiliate. The Kelsey Insti-

SASKATCHEWAN

INDEX TO MAP OF SASKATCHEWAN

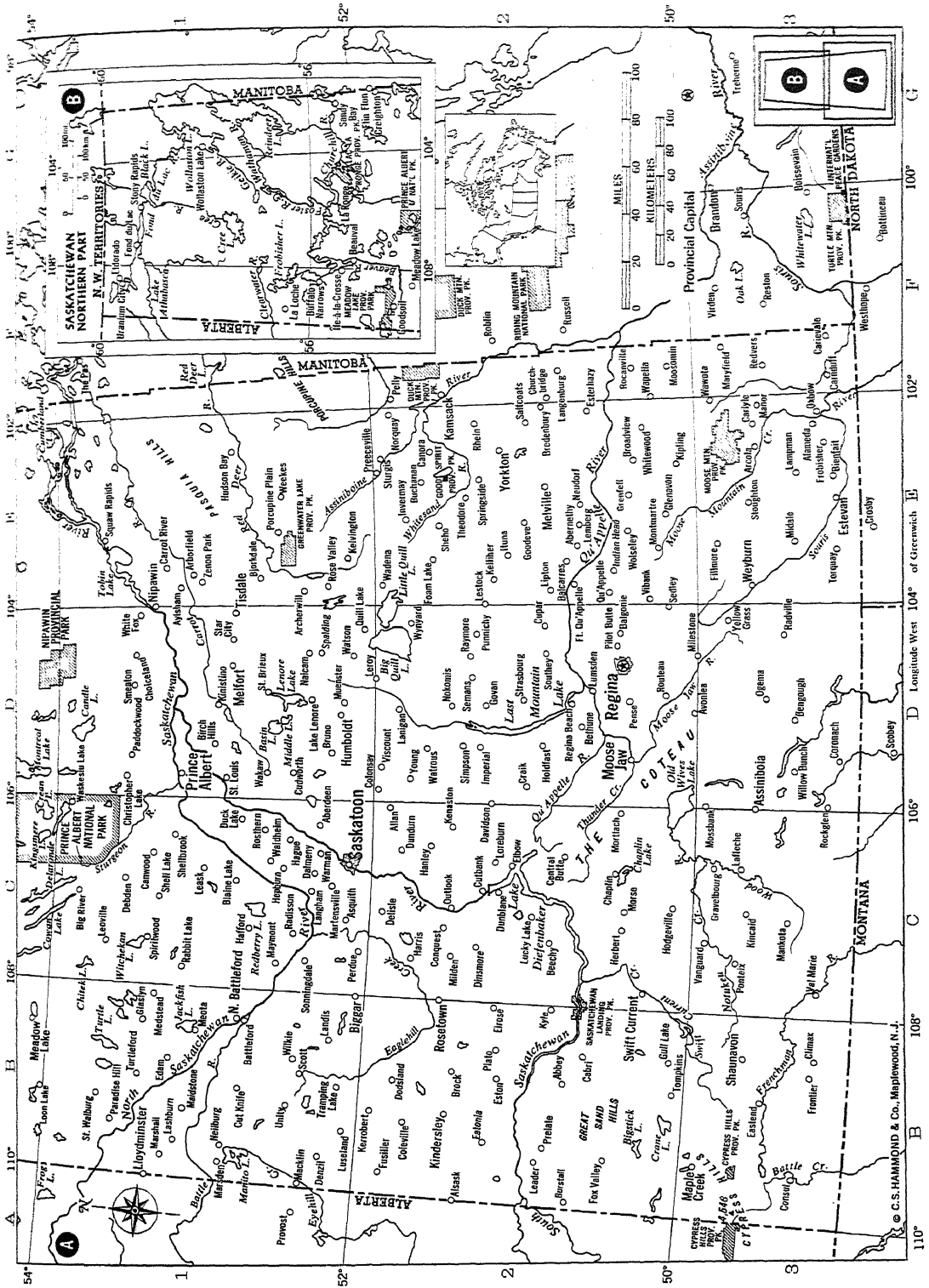
Cities and Towns

Abbey	B 2
Aberdeen	B 1
Abermethy	B 2
Alameda	B 2
Altan	B 2
Alask	B 2
Arboretum	B 1
Archerhill	B 1
Arcoia	B 2
Asquith	B 1
Assiniboia	B 1
Avonia	B 2
Baiecarres	B 2
Baigorie	B 2
Battleford	B 1
Beauval	B 1
Bechy	B 2
Bengough	B 2
Bethune	B 2
Bentall	B 2
Biggar	B 2
Big River	B 1
Birch Hills	B 1
Blaine Lake	B 1
Bredenbury	B 2
Broadview	B 2
Brook	B 2
Bruno	B 1
Buchanan	B 2
Buffalo Narrows	B 1
Burstall	B 2
Cabri	B 2
Canora	B 2
Canwood	B 1
Carnevale	B 2
Carlyle	B 2
Camduff	B 2
Carrot River	B 1
Central Butte	B 2
Chaplin	B 2
Choiceland	B 1
Climax	B 2
Coleville	B 2
Colonsay	B 1
Conquest	B 2
Consul	B 2
Coronach	B 2
Craig	B 2
Creighton	B 2
Cudworth	B 1
Cupar	B 2
Cutbank	B 2
Cut Knife	B 1
Dalmeny	B 1
Davidson	B 2
Debdon	B 1
Delisle	B 2
Denzil	B 1
Dinsmore	B 2
Dodsland	B 2
Duck Lake	B 1
Dundum	B 2
Eastend	B 2
Eatonia	B 2
Edam	B 1
Elbow	B 2
Eldorado	B 1
Elrose	B 2
Esternazy	B 2
Estevan	B 2
Eston	B 2
Fillmore	B 2
Foam Lake	B 2
Fond du Lac	B 1
Fort Qu'Appelle	B 2
Fox Valley	B 2
Frobisher	B 2
Frontier	B 2
Glaslyn	B 1
Glenavon	B 2
Goodsoil	B 2
Govan	B 2
Gravelbourg	B 2
Grenfell	B 2
Gull Lake	B 2
Hafford	B 1
Hague	B 1
Hanley	B 2
Harris	B 2
Hepburn	B 1
Herbert	B 2
Hodgeville	B 2
Hoidfast	B 1
Hudson Bay	B 1
Humboldt	B 1
Île-à-la-Croix	B 2
Imperial	B 2
Indian Head	B 2
Invermay	B 2
Ituna	B 2
Kamsack	B 2
Keltilher	B 2
Kelvington	B 1
Kenaston	B 2
Kerrobert	B 2
Kincaid	B 2
Kindersley	B 2
Kinistino	B 1
Kipling	B 2
Kyle	B 2
Lafleche	B 2
Lake Lenore	B 1
La Loche	B 1
La Ronge	B 1
Lampman	B 2
Landis	B 1
Langenburg	B 2
Langham	B 1
Langan	B 2
Lashburn	B 1
Leader	B 2
Leask	B 1
Lemberg	B 2
Leoville	B 1
Leroy	B 1
Lestock	B 2
Lipton	B 2
Lloydminster	B 1
Loon Lake	B 1
Loreburn	B 2
Lucky Lake	B 2
Lumsden	B 2
Luseland	B 1
Macklin	B 1
Maldstone	B 1
Mankota	B 2
Manor	B 2
Maple Creek	B 2
Marsden	B 1
Marshall	B 1
Martensville	B 1
Maryfield	B 2
Maymont	B 1
Meadow Lake	B 2
Medstead	B 1
Melfort	B 1
Melville	B 2
Meota	B 1
Mildale	B 2
Milden	B 2
Milestone	B 2
Montmartre	B 2
Moose Jaw	B 2
Moosomin	B 2
Morse	B 2
Mortlach	B 2
Mossbank	B 2
Muenster	B 1
Naicam	B 1
Neilburg	B 1
Neudorf	B 2
Nipawin	B 1
Nokomis	B 2
Norquay	B 2
North Battleford	B 1
Ogema	B 2
Outlook	B 2
Oxbow	B 2
Paddockwood	B 1

Paradise Hill	B 1
Pelly	B 2
Pense	B 2
Perdue	B 1
Pilot Butte	B 2
Ponteix	B 2
Porcupine Plain	B 1
Preeceville	B 1
Prelate	B 2
Prince Albert	B 1
Punnichy	B 2
Qu'Appelle	B 2
Quill Lake	B 1
Rabbit Lake	B 1
Radisson	B 1
Radville	B 2
Raymore	B 2
Redvers	B 2
Regina (cap.)	B 2
Regina Beach	B 2
Rhein	B 2
Rocanville	B 2
Rock Glen	B 2
Rosetown	B 2
Rose Valley	B 1
Rosthern	B 1
Rouleau	B 2
Saint Brieux	B 1
Saint Louis	B 1
Saint Walburg	B 1
Saltcoats	B 2
Sandy Bay	B 1
Saskatoon	B 1
Scott	B 1
Sedley	B 2
Semans	B 2
Shanavon	B 2
Sheho	B 2
Shellbrook	B 1
Shell Lake	B 1
Simpson	B 2
Smeaton	B 1
Southey	B 2
Spalding	B 1
Spiritwood	B 1
Springside	B 2
Star City	B 1
Stony Rapids	B 2
Stoughton	B 2
Strasbourg	B 2
Sturgis	B 2
Swift Current	B 2
Theodore	B 2
Tisdale	B 1
Tompkins	B 2
Torquay	B 2
Tramping Lake	B 1
Turtletown	B 1
Unity	B 1
Uranium City	B 1
Val Marie	B 2
Vanguard	B 2
Vibank	B 2
Viscount	B 2
Wadena	B 2
Wakaw	B 1
Waldheim	B 1
Wapella	B 2
Warman	B 1
Waskeiu Lake	B 1
Watrous	B 2
Watson	B 1
Wawota	B 2
Weekes	B 1
Weyburn	B 2
White Fox	B 1
Whitewood	B 2
Wilkie	B 1
Willow Bunch	B 2
Wolseley	B 2
Wynyard	B 2
Wathman	B 2
Yellow Grass	B 2
Yorkton	B 2
Young	B 2
Zenon Park	B 1

Physical Features

Assiniboine (riv.)	B 1
Athabasca (lake)	B 1
Basin (lake)	B 1
Battle (creek)	B 2
Battle (riv.)	B 2
Beaver (riv.)	B 1
Big Quill (lake)	B 2
Bigstick (lake)	B 2
Black (lake)	B 2
Candle (lake)	B 1
Carrot (riv.)	B 1
Chaplin (lake)	B 2
Churchill (riv.)	B 1
Cleanwater (riv.)	B 1
Coteau, The (hills)	B 2
Cowan (lake)	B 1
Crane (lake)	B 2
Crean (lake)	B 1
Cree (lake)	B 1
Cree (riv.)	B 1
Cumberland (lake)	B 1
Cypress (hills)	B 2
Cypress Hills	B 2
Prov. Park	B 2
Delaronde (lake)	B 1
Diefenbaker (lake)	B 2
Duck Mountain	B 2
Prov. Park	B 2
Eaglehill (creek)	B 2
Eyehill (creek)	B 1
Fond du Lac (riv.)	B 1
Foster (riv.)	B 1
Frenchman (riv.)	B 2
Frobisher (lake)	B 1
Geikie (riv.)	B 1
Good Spirit Prov. Park	B 2
Great Sand (hills)	B 2
Greenwater Lake	B 1
Prov. Park	B 1
Jackfish (lake)	B 1
Kingsmere (lake)	B 1
Lac La Ronge	B 2
Prov. Park	B 2
Last Mountain (lake)	B 2
Lenore (lake)	B 1
Little Quill (lake)	B 2
Manito (lake)	B 1
Meadow Lake	B 1
Prov. Park	B 1
Montreal (lake)	B 1
Moose Jaw (riv.)	B 2
Moose Mountain	B 2
(creek)	B 2
Moose Mountain	B 2
Prov. Park	B 2
Nipawin Prov. Park	B 1
North Saskatchewan	B 1
(riv.)	B 1
Notukeu (creek)	B 2
Old Wives (lake)	B 2
Pasquia (hills)	B 1
Porcupine (hills)	B 1
Prince Albert	B 2
Nat'l Park	B 1
Qu'Appelle (riv.)	B 2
Redberry (lake)	B 1
Red Deer (riv.)	B 1
Reindeer (lake)	B 1
Saskatchewan (riv.)	B 1
Saskatchewan Landing	B 2
Prov. Park	B 2
Souris (riv.)	B 2
South Saskatchewan	B 2
(riv.)	B 2
Sturgeon (riv.)	B 1
Swift Current (creek)	B 2
Thunder (creek)	B 2
Tobin (lake)	B 1
Turtle (lake)	B 1
Wathman (riv.)	B 1
Whitesand (riv.)	B 2
Witchekan (lake)	B 1
Wollaston (lake)	B 1
Wood (riv.)	B 2



SASKATCHEWAN

ture of Applied Arts and Sciences and the Saskatchewan Technical Institute offer vocational courses only, at both postsecondary and trades levels. The former has taken over the total responsibility for the nursing diploma (RN) program.

LIBRARIES AND MUSEUMS. The province has eleven public libraries and a provincial library service that provides a central reference service and travelling libraries for rural residents. The University of Saskatchewan Library, the Saskatchewan Legislative Reference Library, and the Archives of Saskatchewan have notable research resources.

The province possesses several important museums. In Regina are the Saskatchewan Museum of Natural History, which is housed in a strikingly modern building, the Royal Canadian Mounted Police Museum, and the Norman Mackenzie Art Gallery on the campus of the University of Regina. Other cultural institutions include the Archives, the Observatory, and the Museum of Anthropology and Archeology, all of the University of Saskatchewan, in Saskatoon; the Mendel Art Gallery, in Saskatoon; the Western Development Museum in Saskatoon, with branches in Yorkton, Moose Jaw, and North Battleford; the Fort Battleford National Historic Park Museum; the Lund Wild Life Exhibit in Prince Albert; the Prince Albert National Park Museum at Waskesiu Lake; and the Moose Jaw Art Museum and Moose Jaw Wild Animal Regional Park.

Grain elevators at Meadow Lake, in western Saskatchewan.

Saskatchewan Govt.

THE ECONOMY

Agriculture is a dominant element in the economy of Saskatchewan, and soils constitute the most important natural resource. Agriculture, in the early 1970's, comprised 48.6 percent of the value added in goods-producing industries, with mining representing 20.6 percent and construction 13.3 percent. Important to the economy is electric power. Installed electric-power generating capacity in Saskatchewan in the mid-1970's was more than 7 billion kw annually, of which 62 percent was thermal, 27 percent hydroelectric, and the remainder internal combustion. Large waterpower resources exist in the central and northern areas of the province, principally on the Churchill, Fond du Lac, and Saskatchewan rivers. Large thermal generation plants have been constructed at Boundary Dam (Estevan) and Queen Elizabeth (Saskatoon).

Manufacturing. Saskatchewan is the least industrialized of the three Prairie Provinces, but industrial activity has increased steadily in recent years. In the mid-1970's the annual total value of shipments for the province was more than \$1.2 billion. About 19,700 persons were engaged in manufacturing, the majority of whom were employed by the food and beverage industries. The leading industries in the province and the annual value of their shipments include the processing of food and beverages (\$462,003,000), petroleum and coal products (\$115,826,000), wood (\$60,457,000), and printing, publishing, and allied industries (\$52,958,000).

Agriculture. Agriculture is extremely important to the economic activity of Saskatchewan.





Saskatchewan Govt.



National Film Board of Canada

The province ranks second nationally in farm cash income. In the mid-1970's annual cash receipts from agriculture totaled about \$2.3 billion. Farms numbered about 71,000, covering some 65,500,000 acres.

The province produces annually about 62 percent of the wheat of Canada. In the mid-1970's Saskatchewan ranked first in national output of rye, rapeseed, and mustard seed; second in oats, barley, and flaxseed; and third in output of peas and in total number of livestock on farms. The annual value of field crops was more than \$2.2 billion. Wheat accounted for about \$1.4 billion, barley was valued at \$305,000,000, and rapeseed accounted for \$181,000,000.

Dairy products are important sources of revenue, and farm cash receipts are annually valued at about \$32,000,000. In the mid-1970's the livestock population included some 2,133,000 cattle, 995,000 calves, 490,000 hogs, 75,000 milk cows, and 4,177,000 hens and chickens.

Fishing. Saskatchewan has approximately 130 lakes that are fished commercially. Most of these lakes are situated in the N. forested region. In the late 1970's the annual catch ran to around 10,800,000 lb. and had a landed value of about \$2,700,000. Primary fishing operations employed about 2100 people. Species taken included pickerel, pike, trout, and whitefish.

Mining. Saskatchewan ranked fifth among the Canadian provinces in value of mineral production. Annual production was estimated at \$929,500,000; mineral fuels accounted for more than \$476,500,000, nonmetallics for \$383,200,000, and metallics for \$24,000,000. The leading metallic minerals by value were copper (\$14,500,000) and zinc (\$6,400,000). The leading nonmetallic, potash (K_2O), accounted for about \$358,500,000. Crude petroleum was valued at \$443,700,000. Saskatchewan ranked first in national output of

Industry in Saskatchewan. Left: A loaded truck leaves a logging camp en route to Cowan Lake landing. Right: A member of a drilling crew descends from a rig after being sprayed with oil from a well near Midale.

potash with 100 percent of the total Canadian production; the province was second in uranium and petroleum, third in natural gas, and fourth in coal and salt.

Major deposits of uranium are located in the far N.W. corner of the province in the Beaverlodge area; copper and zinc are found in the E. on the Saskatchewan-Manitoba border, and petroleum deposits are in the S. and S.W. Potash mining began in Canada in 1962, and by 1971 the country was the largest world producer of this nonmetallic mineral. Major mine projects are located at Saskatoon and Esterhazy. The government announced in 1975 its intention to acquire some and perhaps all of the provincial potash industry, and in January, 1976, the legislature approved a partial takeover.

Forestry. Saskatchewan has about 42,000 sq.mi. of forest land, which is primarily under provincial ownership. The stand of salable timber is estimated at more than 17 billion cu.ft., more than half of which is softwoods. The annual cut approaches 70,265,746 cu.ft. In the mid-1970's annual lumber production was nearly 111,841,000 bd.ft., and the annual value of all sawmill and planing-mill production was about \$13,868,284.

Fur Production. Trapping and fur farming are important economic activities, particularly in the N. forested region. In the mid-1970's annual fur production was valued at about \$7,043,000, of which about 20 percent was ranch-raised pelts and the remainder wildlife. Beaver, mink, muskrat, and coyote account for about 74 percent of the total value.

SASKATCHEWAN

Tourism. The economy of Saskatchewan profits from tourism. The province is visited by more than 1,200,000 persons each year, who spend about \$88,000,000. Among the main attractions are its cities, notably, Saskatoon and Regina, and the national and provincial parks.

Transportation. Saskatchewan is a land of vast distances and scattered population; for this reason the provision of transportation facilities is a formidable technical and financial undertaking. The province has about 9425 mi. of hard-surface roads, 42,523 mi. of roads surfaced mainly with gravel, and 72,000 mi. of unsurfaced roads. The Trans-Canada Highway traverses the s. part of the province. Motor vehicles in Saskatchewan number more than 654,000.

The province has about 8565 mi. of railroad track, including lines belonging to the Canadian Pacific Limited railroad and the Canadian National Railways. The great distances between most communities, particularly those of the N. region, make air travel an important means of transport. The chief airlines are Canadian Pacific Air Lines Limited (CP Air), Air Canada, and Norcan Air. Principal airports are located in Regina, Saskatoon, Moose Jaw, North Battleford, Yorkton, La Ronge, and Prince Albert. The province has well-developed truck and bus transport services, including bus routes operated by the government-owned Saskatchewan Transportation Company and Greyhound Bus Lines of Canada.

Communications. In the mid-1970's Saskatchewan had about 501,000 telephones. Radio stations numbered 20, including 2 French-language stations and a 50,000-watt transmitter operated in Watrous by the Canadian Broadcasting Corporation. A provincially owned high-frequency radio service is operated in N. Saskatchewan. Seven television stations are linked with the rest of the continent by microwave relay. Saskatchewan has 4 daily newspapers and about 100 weekly newspapers, 6 of which are published in French. There are also several farm journals.

GOVERNMENT

The constitution of Saskatchewan is based on the provisions of the British North America Act of 1867, on the Saskatchewan Act of 1905, and on various provincial statutes.

The constitution provides for a government comprising a lieutenant governor, who represents the crown and who is the titular chief provincial official; an executive council or cabinet, which exercises the effective governmental power; and a unicameral, 61-member legislative assembly. The province is represented in the Federal government by 6 Senate members and 12 members of the House of Commons.

The lieutenant governor is appointed by the Canadian cabinet for a term of five years; he is the nominal head of the provincial government but in practice is subordinate to the executive council. The council is selected by the premier, who is leader of the majority party and is responsible to the legislature.

The 61 members of the legislature are elected from the various districts for a maximum term of five years; the body convenes annually. The judiciary comprises, in descending order of importance, four main divisions, namely, the court of appeal, made up of 5 judges, including the Chief Justice of Saskatchewan; the court of queen's bench, made up of 9 judges; district courts and magistrates courts; and a chief judge and 36 judges who hear criminal, small claims, and juvenile cases.

Three main parties are active in provincial political affairs, namely, the Liberal Party, the New Democratic Party, and the Progressive Conservative Party.

Local Government. The units of local government include 11 cities, 135 towns, 344 villages, and 293 rural municipalities governed by elected councils. In addition, the s. two fifths of the province is divided into seven local improvement districts administered by the province. The N. portion of the province, which is sparsely populated, has some municipal services provided by the province through the operation of the northern administration district.

Voting Qualifications. All Canadian citizens eighteen years of age or over are eligible to vote in elections held in Saskatchewan.

HISTORY

The prehistory of the region comprising present-day Saskatchewan is largely unknown, but archeological research indicates the presence of nomadic plains dwellers as early as 1400 B.C. Like the Indians of historic times, the plains dwellers were hunters, not agriculturalists.

Exploration and Settlement. The first European known to have entered the area was the British explorer Henry Kelsey (1670-1729), who in 1690 visited parts of the region on behalf of the Hudson's Bay Company (q.v.). Kelsey, as well as later French and English traders and explorers of the 18th century, encountered a number of Indian tribes, including the Ojibwa (q.v.), a caribou-hunting people of the far north; the Wood Cree (see CREE), moose, caribou, and deer hunters living in the mixed-wood belt; and the Assiniboine and Plains Cree, buffalo-hunting tribes of the south. The Indian tribes provided furs and food supplies for the widely scattered trading posts located in the forest and park

belts. These posts were built by the French, beginning in the 1750's, and by the British, operating through the Hudson's Bay Company, in the 1770's. Following the Treaty of Paris of 1763, all trading was controlled by the Hudson's Bay Company. In 1870, when the company sold its territories to Canada, the area became part of the Northwest Territories.

Expansion and Rebellion. During the years from 1870 to 1905, the so-called territorial period, the southern part of the prairie region was the scene of much activity, notably the negotiation of treaties with the Indians, the extension of land surveys, the building of Northwest Mounted Police posts, the construction of the Canadian Pacific Railway (C.P.R.), the arrival of farmers from eastern Canada, the United States, Great Britain, and continental Europe, and the founding of many urban centers. Almost all the agricultural land was planted with wheat. In 1885 the Federal militia crushed a brief uprising of Indians and métis, that is, Canadians of French and Indian blood; the uprising, which was led by the métis Louis David Riel (q.v.), grew out of the rebels' long-standing fear (dating from the sale of the Saskatchewan region to Canada in 1870) that the national government intended to appropriate and distribute to white farm settlers land that the métis and Indians considered theirs by squatters' rights.

Provincial Status. Following the completion of the C.P.R. in 1885, large numbers of farmers and other settlers poured into Saskatchewan, and the demand grew steadily for a provincial government. The demand was finally met by the Federal parliament, which in 1905 separated Saskatchewan from the Northwest Territories and made the former a province.

The period from 1905 to 1914 was marked by the influx of thousands of immigrants of varied origin, the expansion of transport facilities, a great increase in agricultural production, and the establishment of educational and other governmental institutions. Because the province had no large cities or concentrations of industry, the outlook and aspirations of the agricultural community were the dominant factors in its political and social life. One of the chief phenomena of the period was the growth of producer and consumer cooperatives.

During World War I Saskatchewan made substantial contributions, both in manpower and materials, to the Allied effort. The period was also one of social and political ferment, for the difficulties encountered normally in the assimilation of various immigrant groups were exacerbated by wartime tensions.

The 1920's were years of adjustment to the newly discovered limitations inherent in a one-crop economy. The difficulties encountered by farmers trying to market their wheat crops led to the organization in 1923 of the Saskatchewan Cooperative Wheat Pool, one of the largest grain-marketing cooperatives in the world. The economic crisis also posed a continuing threat to the dominance of the Liberal Party, which had controlled the government since 1905.

During the 1930's the provincial economy collapsed, owing largely to the ravages of drought; the resultant sharp decline in farm income brought hardship, disillusionment, and political unrest. The efforts of local cooperatives and an extensive system of agricultural relief provided by the Federal government only partially alleviated the problems of these depression years. Neither the Conservative Party, which held office from 1929 to 1935, nor the Liberal Party, which regained power in 1935, proved able to satisfy the farmers' demands for a more secure economic and social future. In the elections of 1944 the Cooperative Commonwealth (C.C.F., now the New Democratic Party), which promised a social democracy, won sufficient seats to form the first Socialist government in North America. The C.C.F., led first by T. C. Douglas (1904–) and then by Woodrow Lloyd (1913–), remained the dominant political party until the 1960's.

Recent Developments. The World War II period was marked by agricultural prosperity and increased farm mechanization; at the same time, however, a large exodus took place to the industrial centers of eastern Canada and the Pacific coast. After the war, interest was taken in the encouragement of industrialization and the exploitation of nonagricultural resources in order to stem the loss of population and provide a more balanced economy. Government aid led to the acquisition of woolen and lumber mills, leather tanneries, shoe and box factories, a printing company, and transportation companies. Agricultural income rose substantially in the postwar era, but the province experienced difficulties in the marketing of wheat, which remained the main crop, and in the decline in the rural population, resulting, in part, from mechanization and larger farms. In 1962 the provincial government instituted Canada's first compulsory medical-care plan, an act that caused doctors, fearing state control, to go on strike.

In the June, 1964, provincial elections, the Liberal Party came to power with a promise to free Saskatchewan of the economic stagnation that the Socialist C.C.F. had apparently engendered.

SASKATCHEWAN

The Liberals' failure to relieve this stagnation contributed much to the victory of the resurgent New Democratic Party, under the leadership of Allan E. Blakeney (1925-), in the elections of 1971. By the mid-1970's the worldwide demand for wheat invigorated the whole economy, creating a new prosperity that even the galloping inflation of the times could not endanger. As a result, the tide of emigration from the province was reduced. The Blakeney government has since embarked on a program of agricultural support and economic control designed to husband the land and resources of the province. The government was particularly concerned to limit the power of American interests over Saskatchewan's economy.

STATISTICS CANADA

SASKATCHEWAN, river of central Canada, 547 km (340 mi.) long. It is formed in central Saskatchewan by the confluence of the North Saskatchewan and South Saskatchewan rivers and flows E. into Manitoba, where it passes through Cedar Lake before emptying into Lake Winnipeg. The North Saskatchewan R. (1288 km/800 mi. long) rises in the Rocky Mts. of s.w. Alberta and flows E. past Edmonton, Alberta, and Prince Albert, Saskatchewan. The South Saskatchewan R. (1393 km/865 mi. long) is formed by the juncture of the Bow and Oldman rivers in s. Alberta; it flows N.E. past Medicine Hat, Alberta, and Saskatoon, Saskatchewan. The Saskatchewan R. system is widely used for irrigation, and it has several major hydroelectric facilities, notably Gardiner Dam on the South Saskatchewan R., near Saskatoon, and Grand Rapids Dam, at the mouth of the Saskatchewan R. **SASKATOON**, city of Canada, in Saskatchewan Province, on the South Saskatchewan R., about 140 miles N.W. of Regina. It is the commercial center of a large agricultural area and a leading industrial center. The principal industries are cattle slaughtering, meat-packing, grain storage, and the manufacture of leather goods and sheet metal. The University of Saskatchewan (1907), Saskatchewan Teachers College (1912), and Saint Thomas More College (1936) are located in Saskatoon. The city was laid out in 1883 and expanded through merging with Riverdale in 1906 and with Sutherland in 1956. Pop. (1976) 133,750.

SASSAFRAS, genus of trees and shrubs belonging to the Laurel family, Lauraceae. The genus, which is native to the North Temperate Zone, contains few species, the most important of which is the American sassafras, *S. albidum*, which is cultivated for the bark of its root. The American sassafras is found almost throughout the eastern United States; it grows to bush size

in the northeastern U.S., but attains a height of almost 50 ft. in the south. The leaves are deciduous, and the wood is yellow and soft. The bark of the root has long been used in medicine as a stimulant and diuretic. The bark also contains a volatile oil, oil of sassafras, which is used in perfumery. Extracts of sassafras bark are used as bitter and flavoring agents in the preparation of beverages. The yellow flowers, which are borne in racemes, have a six-lobed calyx and a six-lobed corolla. The male flowers have nine stamens; the female flowers bear a solitary pistil. The fruit is a blue drupe, borne on a red pedicel or stalk.

SASSANIDAE. See PERSIA: *The Sassanians*.

SASSARI, city of Italy, in Sardinia Region, and capital of Sassari Province, on the island of Sardinia, about 10 miles S.E. of its port Porto Torres on the Gulf of Asinara, and 112 miles N.W. of Cagliari. Cereals, wine, vegetables, and livestock from surrounding areas are marketed in the city. Sassari is the site of a 13th-century Romanesque church, a 12th-century Pisan church, and the University of Sassari (founded 1556). In the surrounding region are numerous stone constructions, called nuraghi, built by the prehistoric inhabitants of Sardinia. Of ancient origin, Sassari became a free commune in the 13th century but soon fell (1294) under Genoese rule. In the 14th century it passed to the kings of Aragón; see ARAGÓN. It was sacked by the French in 1527. During World War II (q.v.) it was bombed by the Allies. Pop. (1971) 107,294.

SATAN. See DEVIL.

SATANISM, cult of Satan and phase of occultism (q.v.); see DEMON; DEVIL; FAUST, JOHANN. From the character of its worship it is necessarily secret, and precise details are difficult to acquire. The cult is an old one and in its origins reaches far back into primitive religion; see RELIGION. As for the actual phenomena presented by Satanism, the cult reaches its acme in the Black Mass, which is supposed to stand in the same relation to it as does the Christian Mass (q.v.) to Christianity. According to a generalized description, based on the sparse material available, the celebrant of the Black Mass, who must formerly have been a priest (q.v.), is clad in sacrificial vestments resembling those worn by Christian celebrants; see VESTMENTS, ECCLESIASTICAL. His chasuble may bear the figure of a goat, and his deacon, a woman dressed in scarlet, holds a scarlet biretta. Upon the altar is an inverted cross (q.v.). Incense (q.v.) is mixed with a foul-smelling substance. A Black Credo, a blasphemous antithesis of the Apostles' Creed (see CREEDS), may be recited.

Satanism seems to be in great part a survival of the worship of demons, for it does not regard Satan as beneficent or as ill-treated but as a fiend more powerful than the powers of good, who have been unable to keep the promises made to the world. The history of Satanism is obscure. Attempts have been made to prove that the French marshal Gilles de Laval, Baron de Retz, or Rais (1404-40), was one of its first adherents. Satanism has maintained itself stubbornly since about his time, and was revived in France during the reign of King Louis XIV (q.v.).

See also WITCHCRAFT.

SATELLITE, in astronomy, secondary object that revolves in a closed orbit about a particular planet (q.v.). The best-known satellite is the moon (q.v.) which revolves about the earth. Mercury, Venus, and Pluto have no satellites; Mars has two; Jupiter, twelve; Saturn, ten; Uranus, five; and Neptune, two. The motion of most satellites about their planets is direct, from west to east, and in the same direction as the rotation of their planets. Only the following satellites revolve in the retrograde direction, from east to west, and opposite the direction of rotation of their planets: satellites eight, nine, eleven, and twelve of Jupiter; Phoebe, the outermost satellite of Saturn; and Triton, the larger satellite of Neptune. The orbits of the five satellites of Uranus, like the equator of the planet, are almost

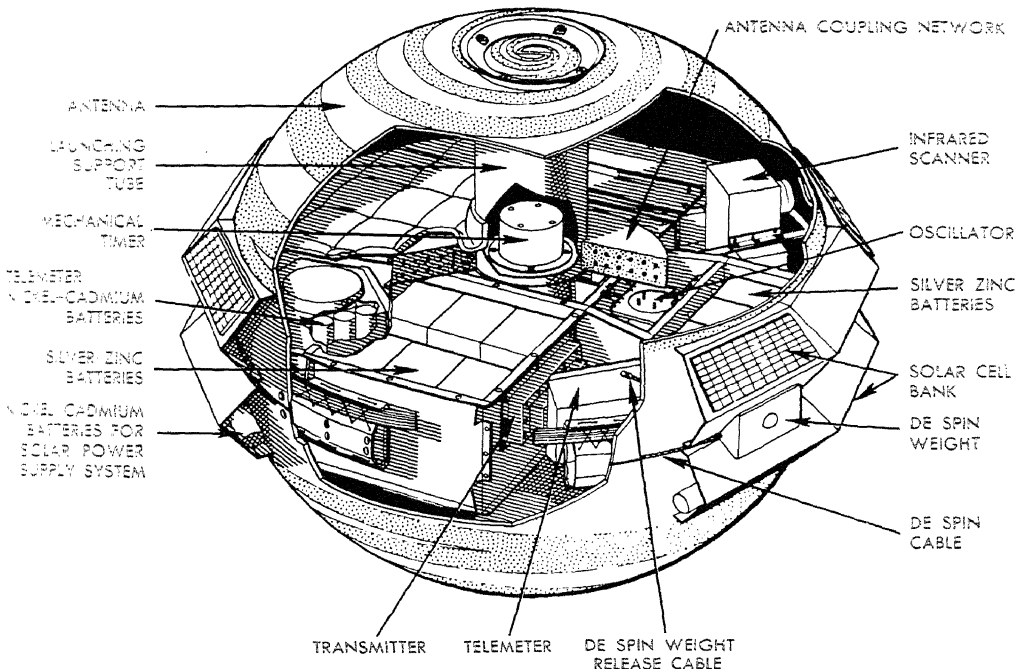
perpendicular to the orbit of Uranus. Many astronomers believe that Pluto (q.v.), which moves in an independent orbit about the sun, is an escaped satellite of Neptune (q.v.). Satellites are also called secondary planets. Information about the satellites is given in the individual articles on the planets to which they belong. See SOLAR SYSTEM.

SATELLITE, ARTIFICIAL, one of many man-made objects orbiting in space around the earth. See ASTRONAUTICS for satellite orbits, altitudes, speeds, escape velocity, weightlessness, and history; see also ESCAPE VELOCITY; ROCKET.

Unmanned Satellites. These objects carry instruments and equipment to detect and measure conditions in space and in the upper atmosphere, such as: air density, temperature, and ionization (q.v.); solar radiations (see INFRARED RADIATION; LIGHT; ULTRAVIOLET RADIATION; X RAY); cosmic radiation (see COSMIC RAYS); number and size of micrometeorites; strength and direction of the magnetic field of the earth; and the albedo, or light-reflecting power, of the earth. The satellites are powered by fuel cells (q.v.); they carry radio transmitters, powered by solar cells that convert the energy of the rays of the sun into electricity; see SOLAR POWER. The trans-

Cutaway drawing of the U.S. Navy Transit satellite. The sphere is 36 in. in diameter and weighs 265 lb.

U.S. Navy



SATELLITE, ARTIFICIAL

mitters automatically send radio signals to receiving stations on earth. The signals give the readings of the satellite-borne instruments. This transmission of instrument data is called *telemetry* (q.v.). See also **ELECTROMAGNETIC RADIATIONS**.

Other purposes of unmanned artificial satellites are: radio, television, and telephone communications (see **COMMUNICATIONS SATELLITE**); biological experiments, such as studies of the effects of weightlessness and space radiations upon plants, animals, and microorganisms (see **SPACE BIOLOGY**); weather observations (see **WEATHER SATELLITE**); and astronomical observations made with telescopes and cameras carried aboard satellites; see **TELESCOPE**. Astronomical telescopes on earth must look through the atmosphere (q.v.), which alters and limits the quality of the image and the accuracy of the observations because of air-density fluctuations, atmospheric dust and pollution, and spectral absorption by the atmosphere. An astronomical telescope aboard a satellite can look directly into space without atmospheric interference.

The shape of the earth, for example, the bulge at the equator, affects the uniformity of the gravitational field in space through which a satellite orbits. This slightly perturbs the orbital path of each satellite. Accurate observation of the orbital path of a satellite therefore gives data from which the shape of the earth can be computed. See also **GEOPHYSICS: Geodesy**.

A number of Tiros andITOS meteorological satellites, designed by the Environmental Science Services Administration, later renamed National Oceanic and Atmospheric Administration (q.v.), were put into orbit in the late 1960's and early 1970's. These utilized vidicon, or photoconductive, camera systems, radiometers, a variety of sensors, and other sophisticated instruments to transmit valuable data by telemetry. This enabled meteorologists and scientists to make much more precise observations of the earth and its atmosphere. The Transit satellite of the United States Navy is an unmanned artificial navigation satellite used by ships and aircraft to determine their locations accurately. The Transit satellite continuously sends out radio signals that are received by special equipment aboard the ships and aircraft. The frequency of the received signals changes because of the motion of the satellite in its orbit. This frequency change (called the Doppler shift) enables the ship or aircraft to compute its position; see **DOPPLER'S PRINCIPLE**; **NAVIGATION**.

Other uses of artificial satellites include photographic surveying of the earth for accurate mapmaking; monitoring earthquake-prone

areas; collecting data on food, fish, and timber stocks; locating mineral deposits; identifying pollution sources; and military-intelligence gathering; see **AERIAL SURVEY**; **MAP**; **SURVEYING**.

Manned Satellites. These satellites have been used by the United States and the Soviet Union in sending men on spaceflights to the moon and to earth-orbiting space stations. Manned satellites can perform all the functions of unmanned satellites, with the added advantage that men aboard the satellite can adjust and repair equipment and exercise judgment in the course of experiments and observations. Early in 1971, the Soviet Union launched an orbiting space laboratory, Salyut, to which teams of cosmonauts were later sent to carry out a number of tests on the medical effects of prolonged weightlessness. In May, 1973, the U.S. launched a similar laboratory, called Skylab, to which teams of astronauts were sent to spend up to eighty-four days in orbit relaying scientific data back to earth. See **ASTRONAUTICS**.

SATIE, Erik, full name ALFRED ERIK LESLIE SATIE (1866-1925), French composer, born in Honfleur. He studied music at the Paris Conservatory and the Paris Schola Cantorum. Some of his most successful works were piano pieces with deliberately ridiculous titles, such as *Limp Preludes for a Dog* (1913). As a rebel against the heaviness and complexity of the music of his times and as an innovator in his use of certain harmonic devices, he anticipated the future trend of French music. Many younger composers hailed him as a master; particularly the young innovators known as Les Six; see **MUSIC: The 20th Century**; **SIX, LES**. He also influenced such older French composers as Claude Debussy and Maurice Ravel (qq.v.). Among his other works are the musical scores for the ballets *Parade* (1917) and *Mercure* ("Mercury", 1924); the piano suite *Gymnopédies* (1888), which was orchestrated by Debussy; and *Socrate* (1918), a work for four sopranos and chamber orchestra, based on Plato's dialogues.

SATINWOOD, satinlike wood, found in both India and the West Indies, used in fine cabinetwork. The eastern species is obtained from a moderate-sized deciduous tree, *Chloroxylon swietenia*, growing in central and south India, including Ceylon. West Indian satinwood comes chiefly from the Dominican Republic, Puerto Rico, and the Florida Keys. Satinwood, of either kind, is hard, very close-grained, and takes a fine polish.

SATIRE, branch of literature employing irony, derision, or wit to expose human faults such as folly, wickedness, or pretense.



At home aboard the orbiting satellite Skylab. Above: During their twenty-eight-day stay in orbit in 1973, physician-astronaut Joseph P. Kerwin gives an oral and dental examination to Skylab commander Charles (Pete) Conrad, Jr., under zero-gravity conditions. Right: Scientist-astronaut, Owen K. Garriot, a member of the second three-man crew that spent fifty-nine days in Skylab, deploys an instrument to collect interplanetary dust particles on one of the huge solar panels.

NASA



Masters of Satire in Antiquity. Writers of ancient Greece employed what could be called satire in their poetry and plays. Examples are the lusty comedies of Aristophanes, written in the 5th century B.C. and still performed today, and the vituperative verses of Archilochus, dating from the early 7th century B.C. Satire as a distinct branch of literature, however, was created by the practical minded Romans who gave the new genre the name *satira*, derived from a word meaning satiated or filled with food. The licentious Fescennine folk verses, sung by rural Etruscans at festivals and weddings, were the historical sources of Roman satire. True literary satire was founded by the Roman poet Lucilius in the 2nd century B.C. Lucilius wrote thirty books of highly original *Satires*, presenting in both new and distinct verse forms his savagely outspoken views on an incredibly wide variety of subjects.

Two Roman poets influenced by Lucilius and important in the development of satire as literature are Horace, whose first book of *Satires* appeared in 35 B.C., and Juvenal, who wrote from about 100 A.D. to 128 A.D. Horace founded the school of the gentle thrust, concerned more with folly than with wickedness, while Juvenal, revolted by immorality, wrote fiercely and fur-

ously. The sixteen verse satires by Juvenal reflect his profound Stoicism (q.v.) in their exposure of all the many vices of Roman society.

Other satirists of the classic period were the Greek Lucian, who ridiculed the rich and pretentious in his *Dialogues* (150-70); and many Romans, including the fastidious and not very productive Persius; Gaius Petronius, author of the famous *Satyricon* (1st century A.D.), a witty and realistic picture of upper-class licentiousness; Martial, whose *Epigrams* (1st century A.D.) are cruel, terse, and sophisticated; and Apuleius, whose *The Golden Ass* (2nd century A.D.) provided a model for many picaresque novels of later centuries.

Medieval and Renaissance Forms. In medieval literature, satire is represented by the fabliau (q.v.), popular from the 12th to the 14th centuries. Fabliaux, short tales in verse, dealt in comic and ribald fashion with everyday medieval life. "The Miller's Tale", from *The Canterbury Tales* written by the 14th-century English poet Geoffrey Chaucer, is an example. A contemporary of Chaucer, possibly named William Langland, was responsible for *The Vision of William Concerning Piers the Plowman*, the most significant work in Middle English aside from *The Canterbury Tales*; the satire of the author of

SATIRE

Piers Plowman is directed primarily at hypocrisy in the Church.

A remarkable quartet from four different lands carried satire into the Renaissance (q.v.): Erasmus, the Dutch humanist; Giovanni Boccaccio, the Italian teller of tales; François Rabelais, the French novelist; and Miguel de Cervantes Saavedra, the Spanish creator of the great burlesque character Don Quixote.

Increase in Use and Invective. The Elizabethan age in England produced some early theatrical satire in the plays of Ben Jonson and Thomas Middleton; there are notable satiric passages also in the plays of William Shakespeare. Later, during the Restoration (q.v.), Samuel Butler produced a satiric masterpiece, *Hudibras* (1663–78), a burlesque of Puritanism (see PURITANS). John Dryden was another author of 17th-century England noted for his many successful excursions into the realm of the classic narrative satire in verse. In 17th-century France, the comedies of the actor and playwright Molière and the poetry of the critic Nicolas Boileau-Despréaux criticized manners and matters both public and private.

What has been called the golden age of satire occurred in England early in the 18th century, when satire became the predominant literary form. Such writers as Joseph Addison, Alexander Pope, Henry Fielding, Tobias Smollett, and Jonathan Swift produced a wealth of satiric novels, essays, and poetry. These writers freely followed the Horatian or the Juvenalian tradition of ancient Rome, either gently nudging their subject or ruthlessly attacking it. In France at the same time, the author and philosopher Voltaire in his espousal of the Enlightenment (q.v.) naturally employed satire as he critically examined all previously accepted doctrine.

In Modern Literature. Authors found little outlet for their satiric bent in the Romanticism (q.v.) of the 19th century. But as the century wore on, authors in England began to poke a little fun at their compatriots. Manners and mores of the Victorians were exposed in the novels of William Makepeace Thackeray, Charles Dickens, and Samuel Butler and in the plays of W. S. Gilbert, George Bernard Shaw, and Oscar Wilde.

In America the tradition of political and social satire began early in the 19th century with the essays and stories of Washington Irving and continued with the works of James Russell Lowell, Oliver Wendell Holmes, and Samuel Langhorne Clemens who used the pen name Mark Twain. These were identifiably American authors who produced satiric works in a wide variety of literary forms.

The 20th century, with literary theories, schools, and practitioners proliferating at a fantastic rate, brought a blurring of the lines. No longer did the classic concept of a satire as a well-defined long poetic work exist. Satiric touches became more and more incidental to a work, rather than acting as the primary inspiration of the work. Among 20th-century authors who may nevertheless be called satirists are the British writers Noël Coward, Aldous Huxley, Evelyn Waugh, and a group of angry, formerly young men led by Kingsley Amis. In the United States, Sinclair Lewis, James Thurber, H. L. Mencken, and Nathanael West, among many others, wrote works primarily motivated by their satirical intentions.

Satiric effects have been employed by authors writing in languages other than English. The German tradition, for example, extends from Jean Paul Richter through Bertolt Brecht to Günter Grass; the French from Honoré de Balzac through Anatole France to Eugène Ionesco. In the late 19th-century Henrik Ibsen in Norway and August Strindberg in Sweden both deftly wove satire into their writings.

The proliferation of new media of communications in the 20th century widened the opportunities for satirists. Writers for motion pictures, television, and the contemporary theater are frequently occupied with producing satiric effects. In the U.S. today, pure literary satire is approximated in only two fields, the political column and the comic strip (q.v.). Two leading examples of the satiric columnist are Art Buchwald (1925–) and Orville Prescott (1906–), while satiric comic strips are drawn by such artists as Al Capp, creator of *Li'l Abner*; Walt Kelly (1913–73), of *Pogo*; and Charles M. Schulz (1922–), of *Peanuts*.

See separate articles on persons whose birth and death dates are not given.

See also BURLESQUE; CARICATURE; PARODY.

SATO, Eisaku (1901–75), Japanese statesman and winner of the Nobel Peace Prize.

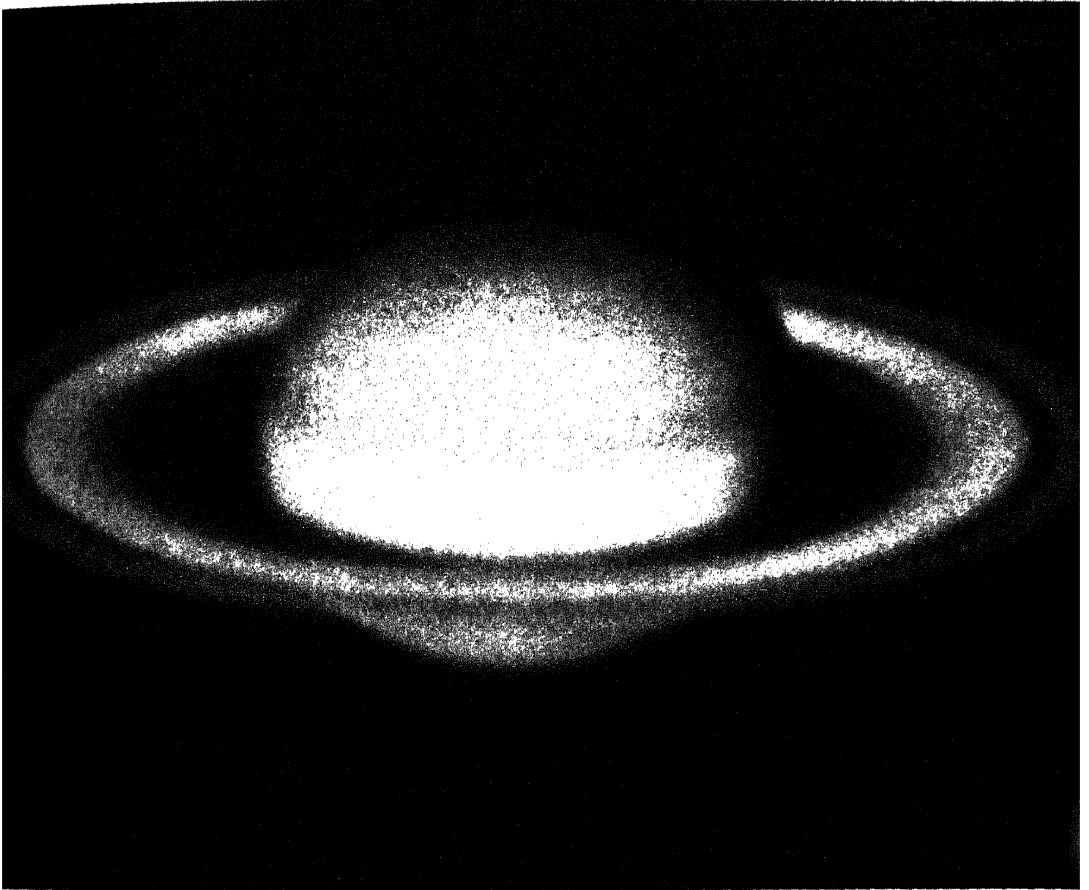
Born March 27, 1901, in Tabuse, Japan, Sato received a law degree from Tokyo Imperial University (1924), and joined the ministry of railways. He was elected to the lower house of the Diet in 1948 as a Liberal and later served in several cabinet posts. In 1964 he became prime minister. Under Sato's guidance the country continued to grow as a major power. In 1969 he signed a treaty with the United States for the return of the Ryukyu Islands to Japan and removal of U.S. nuclear weapons from the region, but was forced to resign in 1972 because he had allowed some U.S. forces to remain on Okinawa.

-awa. He was awarded the 1974 Nobel Peace Prize for his role in the conclusion of a nuclear nonproliferation pact. Sato died June 2, 1975, in Tokyo.

SATURDAY, seventh day of the week, is named to honor the Roman god Saturn (q.v.). It was called *Sater-daeg* by the Anglo-Saxons. It is the holy day of the Israelites of the Old Testament, and in Hebrew is called Sabbath (q.v.), the only day of the week with a name, the rest being numbered. It is thought that the word "sabbath" derives from the Hebrew word for

Norway it is *Lørdag*. In Spanish it is *el sabado* and in Italian *sabato*, both derived from sabbath. Several Christian sects, notably the Seventh-Day Adventist Church (q.v.), have reverted to Old Testament practice and observe Saturday as their day of worship.

SATURN, sixth major planet in order of distance from the sun and the second largest of the planets. It was the most remote planet known to astronomers until the discovery of Uranus (q.v.) in 1781. Saturn is about 885,900,000 mi. away from the sun and completes a revolution about



rest, in that the Jews were enjoined from working on the seventh day. It begins at sunset Friday and lasts until sunset Saturday. In the early days of Christianity, the holy day gradually shifted to Sunday, which, as the first day, was deemed more appropriate since it was the day of the resurrection of Jesus Christ (q.v.) and the day on which creation began. In Latin, Saturday is called *dies Saturni*, and Sunday the equivalent of the Lord's day. In Sweden, however, Saturday is *Lördag*, or Lord's Day; and in Denmark and

Saturn, the second largest planet in the solar system, and its rings, as viewed through the 60-in. telescope at the Hale Observatories in California.

The California Institute of Technology and
the Carnegie Institution of Washington

the sun once every 29.46 years. Like Jupiter (q.v.) and the earth it is flattened at the poles; the diameter at the equator (75,500 mi.) is greater than the diameter at the poles (67,500 mi.). The mean diameter of the planet is about 72,500 mi., which is slightly more than nine times that of

SATURN

the earth. Saturn's volume is about 762 times, and its mass is 95.3 times that of the earth; its mean density, which is lower than that of any other planet, is 0.7 that of water. The gravitational pull is about equal to that on the earth.

The albedo, or reflecting power of the planet, is 0.63; the stellar magnitude varies from about 0 to 1.5. When seen with the naked eye, Saturn appears as a bright star. Through the telescope the surface of the planet appears yellowish; it is marked with a few belts parallel to the equator, similar to but fainter than those observed on Jupiter. Spots on the surface of Saturn are also faint, and they are short-lived compared with those on Jupiter. Calculations of the period of rotation, based on the movement of spots on the surface, indicate that the portion of the surface near the equator has a shorter period of rotation about the planet's axis than portions of the surface at other latitudes. The mean period of rotation is about 10 hr. 26 min. The variation of the speed of rotation at different sections of the planet, the high speed of rotation, and the low density indicate that the central core of the planet is either solid, but very small and completely surrounded by a thick atmosphere, or is fluid. Spectrographic examination of Saturn's atmosphere shows that it is similar to that of Jupiter; that is, it is composed of methane and ammonia. Saturn, however, has more methane and less ammonia than Jupiter has. The surface temperature of Saturn is about -238°F. (-114°C.).

The Rings of Saturn. The distinctive feature of Saturn is the system of rings that encircle the planet. Evidence of the rings was first observed by the Italian scientist Galileo Galilei (q.v.), who did not know how to describe or account for the phenomenon. The Dutch scientist Christian Huygens (q.v.) was the first to describe the rings. In 1655, desiring further time to verify his explanation of the phenomenon without losing his claim to priority, Huygens wrote a series of letters in code, which when properly arranged formed a Latin sentence that read in translation: "It is girdled by a thin flat ring, nowhere touching, inclined to the ecliptic". Twenty years later the French astronomer Jean Dominique Cassini (1625-1712) observed that the rings were separated into two separate parts, and in the middle of the 19th century the American astronomer George Phillips Bond (1825-65) further resolved one of the two rings into two separate rings. The three rings are designated as A, B, and C, or outer, inner, and crape or dusky rings, starting with the ring farthest away from Saturn. The outer ring has a diameter of about 173,000 mi. and is about 23,000 mi. wide; the inner ring

has a diameter of about 145,000 mi. and is 33,000 mi. wide. These outer and inner rings are separated by a distance, known as the Cassini division, of 2500 mi. The dusky ring, which appears to touch the inner ring, is about 11,000 mi. wide, and is separated from the planet by a gap of about 7000 mi. A faint fourth ring, D, between the dusky ring and the surface of Saturn, was reportedly discovered by astronomers at the Pic-du-Midi Observatory in France in 1969, but it has not been confirmed. The thickness of the rings is not more than 20 mi. The composition of the rings of Saturn has been a subject of interest to astronomers ever since their discovery. The Scottish physicist James Clerk Maxwell (q.v.) proposed the theory, later confirmed by spectrographic observations, that the rings consist of millions of small particles, or minute satellites, moving in orbits about the planet. In the latter part of 1969 the Lunar and Planetary Laboratory at the University of Arizona announced that the spectral analysis of the rings shows them to be largely formed of chunks of ammonia ice. The U.S. spacecraft Pioneer XI, which flew past Jupiter in December, 1974, is expected to transmit significant data about Saturn and its rings when it passes close to the planet in 1979.

Satellites. In addition to the particles that make up the ring system, Saturn is attended by ten satellites, named, starting with the innermost, Janus, Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Iapetus, and Phoebe. In 1905 the satellite Themis was reported, but the existence of this satellite has not been confirmed. The existence of the innermost satellite Janus was confirmed in December, 1966. The outermost satellite is more than 7,000,000 mi. from Saturn and has a period of revolution of 550 days. The brightest and largest of the satellites is Titan, which has a diameter of about 3500 mi. See PLANET. P.B.G.T.

SATURN, in Roman mythology, ancient god of agriculture. In later legends he was identified with the Greek god Cronus (q.v.) who, after having been dethroned by his son Jupiter (q.v.), fled to Italy where he ruled during the Golden Age (q.v.), a time of perfect peace and happiness. Each year, during the festival known as the Saturnalia (q.v.), the Golden Age was restored for seven days. All business was stopped, executions and military operations were postponed, slaves were temporarily freed and treated by their masters as equals, and presents were freely exchanged.

Saturn was the husband of Ops, goddess of plenty. He was the father of Juno, goddess of

marriage, Neptune, god of the sea, Pluto, god of the dead, and Ceres (q.v.), goddess of the grain. In art Saturn is usually shown bearded, carrying a sickle or an ear of corn.

SATURNALIA, ancient Roman festival in honor of Saturn (q.v.), god of agriculture, celebrated on December 17. It was originally confined to this one day, on which religious rites were celebrated, but the festivities in the time of the Roman Republic lasted for as many as seven days. The Saturnalia seems originally to have been a harvest festival, connected with the completion of late sowing, but the ritual was so transformed by the hellenizing of Saturn and his worship (see ROMAN RELIGION AND MYTHOLOGY) that its agricultural meaning was lost. During the Saturnalia the courts and schools were closed, and military operations were suspended so the army might celebrate. It was a period of good will, devoted to banquets, the exchange of visits, and the giving of presents. A special feature of the festival was the freedom given to slaves, who at this time had first place at the family table and were served by their masters. See FESTIVALS AND FEASTS.

SATYRS, in Greek mythology, deities of the woods and mountains, with horns and tails, and sometimes with the legs of a goat. The satyrs were the companions of Dionysus (q.v.), god of wine, and spent their time pursuing nymphs, drinking wine, dancing, and playing the syrinx (q.v.), flute, or bagpipes.

SAUDI ARABIA, kingdom of w. Asia, occupying most of the Arabian Peninsula, and bounded on the n. by Jordan, Iraq, and Kuwait, on the e. by the Persian Gulf and Qatar, on the s.e. by the Union of Arab Emirates and Oman, on the s. by the Yemen Arab Republic and the People's Democratic Republic of Yemen, and on the w. by the Red Sea and the Gulf of 'Aqaba. It extends approximately between lat. 16°30' N. and lat. 32°20' N. and long. 34°40' E. and long. 56° E. Undefined boundaries on the s. and s.e. result in estimates of the area that vary from 600,000 to 850,000 sq.mi.

THE LAND

Considerably more than one half of the area of Saudi Arabia is desert. Rub' al Khali, known in English as the "Great Sandy Desert" and the "Empty Quarter", extends over much of the s.e. and beyond the southern frontier. Largely unexplored, Rub' al Khali has an estimated area of 300,000 sq.mi. An extension of the Syrian Desert projects into northern Saudi Arabia, and extending s.e. from this region is the Nefud, an upland desert of red sand covering an area of about 22,000 sq.mi. The Dahna, a narrow extension of

this desert, links the Nefud and Rub' al Khali. A plateau region, broken in the e. by a series of uplifts, extends westward from the Nefud. Several watercourses (wadis), dry except in the rainy season, traverse the plateau region. The western limits of the latter are delineated by a mountain range extending generally n.w. and s.e. along the e. edge of Hejaz. Between the range, which has an average elevation of about 4000 ft., and the Red Sea is a coastal plain with a maximum width of about 30 mi.

Extreme heat and aridity are characteristic of most of the country. Summer temperatures often rise above 120° F. Total rainfall is less than 10 in. annually.

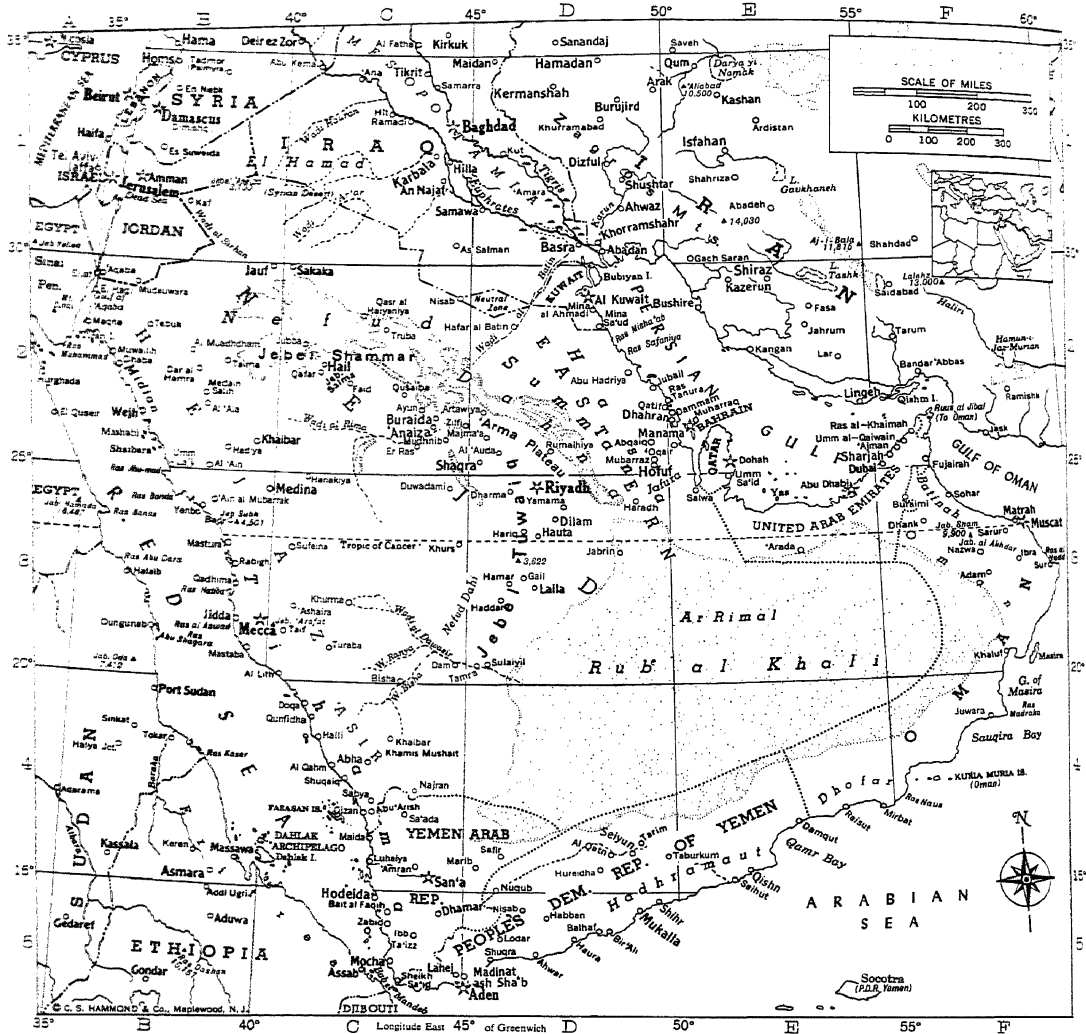
Natural Resources. Fertile oases, many of which are the sites of towns and villages, are scattered through the deserts n. of Rub' al Khali, and there are larger tracts of pasturage in the Dahna and plateau region. The Saudi Arabian oil fields are located in the coastal area adjoining the Persian Gulf. Because of the general aridity the vegetation is not extensive. Various fruit trees, notably the date palm, and a wide variety of grains and vegetables thrive in the oases and in other areas where water is available. The indigenous wildlife includes the hyena, fox, wildcat, panther, wolf, gazelle, antelope, wild cow, ibex, ostrich, bustard, quail, and pigeon.

THE PEOPLE

The population is mainly composed of descendants of indigenous Arab tribes, with some admixture of Negro blood from slaves imported from Africa. Nomadic tribesmen, known as Bedouins (q.v.) comprise about 50 percent of the population; some 25 percent are urban dwellers, but this proportion is increasing steadily under the impact of industrial expansion. The remainder of the population is composed of settled cultivators. The national language is Arabic. Virtually all Saudi Arabians are Muslims of the Wahhabi sect; see WAHHABIS. The results of a census taken in 1964 have never been released, but a United Nations provisional estimate (1972) indicated a population of 8,199,000. Other estimates range as low as 3,500,000.

Political Divisions and Principal Cities. Saudi Arabia is divided into four provinces: Nejd, Hejaz, Asir, and Al Hasa, the first three being formerly independent states (see ARABIA: History). Each region is administered by a governor directly responsible to the king. The largest cities are Riyadh, the royal capital (pop., 1970 est., 300,000); Mecca, the religious capital (250,000); Jidda, a port city on the Red Sea (300,000); and Medina, a holy city and cultural center of Islam (60,000).

SAUDI ARABIA



Education. Education in Saudi Arabia is free but not compulsory. In the mid-1970's the country had approximately 2154 primary schools with a total enrollment of about 475,000, 486 intermediate schools with 83,729 students, and 141 secondary schools with over 23,000 students. In recent years institutes for teacher training have been established in Medina and Mecca, with the aim of reducing the country's great dependence on other Arab countries for teachers. The University of Riyadh was founded in 1957, the Islamic University in Medina in 1961, and King Abdul Aziz Private University at Jidda in 1967. Three other institutions of higher learning are the Higher Institute of Technology at Riyadh, the University of Petroleum and Minerals at Dhahran, and the Shari'a College of Islamic Jurisprudence at Mecca. Institutes for religious training are located in Riyadh and nineteen

other cities and towns. Instruction at the higher levels is frequently in English, which, after Arabic, is the major language. Every year a number of qualified young Saudi Arabians enroll for advanced study in Europe and the United States.

THE ECONOMY

Agriculture and stock raising have historically been the basic economic activities, but since the development of the oil industry and the income produced by it, the government has sought to diversify its industrial base and improve its basic economic structure, including roads, airports, seaports, and the power industry. The main deterrent has been the lack of trained or skilled labor. With the quadrupling of international oil prices in 1973, however, the government set about transforming its economy at an accelerated rate almost without precedent

INDEX TO MAP OF SAUDI ARABIA

Cities and Towns

Absa	.....C 4
Abqaiq	.....D 2
Abu 'Arish	.....C 4
Abu Hadriya	.....D 3
Ain al Mubarrak	.....D 3
Ain	.....D 3
Al 'Ain	.....D 3
Al 'Ain	.....D 3
Al 'Auda	.....D 3
Al Lith	.....C 2
Al Muadhdham	.....C 2
Al Qahm	.....C 4
'Anaiza	.....C 3
Artawiya	.....C 3
'Ashair	.....C 3
Avun	.....C 3
Badr	.....C 3
Bisha	.....C 3
Buraide	.....C 3
Dam	.....C 3
Dammam	.....C 3
Dar al Hamra	.....C 3
Dhaka	.....C 3
Dhahran	.....C 3
Dhurma	.....C 3
Dila	.....C 3
Doga	.....C 4
Duwadimi	.....C 3
Gail	.....D 3
El Haql	.....C 3
Er Ras	.....C 3
Fajd	.....C 3
Haddar	.....D 3
Hadiya	.....B 2
Hafar al Batin	.....C 2
Hail	.....C 2
Halli	.....C 4
Hamar	.....D 3
Hanakiya	.....C 3
Haradh	.....D 3
Hauta	.....D 3
Hofuf	.....D 3
Jabrin	.....D 3
Jauf	.....D 3
Jidda	.....C 3
Jubba	.....D 3
Jubail	.....C 1
Kaf	.....C 4
Khaibar ('Asir)	.....C 2
Khaibar (Hejaz)	.....C 2
Khamis Mushait	.....C 4
Khurma	.....C 3
Khurs	.....C 3
Laila	.....D 3
Majma'a	.....C 3
Maqna	.....C 3
Mastaba	.....C 3
Mastura	.....C 3
Mecca (cap.)	.....C 2
Medain Salih	.....C 3
Medina	.....C 3
Mubarraz	.....D 3
Mudhrib	.....B 2
Muwailih	.....B 2
Najran	.....C 4
'Oqair	.....D 2
Oadhma	.....C 3
Qafar	.....C 2
Qasr al Haiyaniya	.....C 2

Qatif	.....D 2
Qizan	.....C 4
Qunfidha	.....C 4
Qusaiba	.....C 2
Rabigh	.....C 3
Riyadh (cap.)	.....D 3
Rumaihiya	.....D 2
Sabya	.....C 4
Sakaka	.....C 2
Shaqra	.....C 2
Shuqaiq	.....C 4
Sufeina	.....C 3
Sulayyil	.....C 3
Taif	.....C 3
Taima	.....C 3
Tamra	.....C 3
Tebuk	.....C 2
Truba	.....C 2
Turaba	.....C 3
Umm Lajj	.....C 2
Wejh	.....C 2
Yamama	.....D 3
Yenbo	.....C 3
Zilfi	.....C 2
Barida, Ras (cape)	.....B 3
Bisha, Wadi	.....C 4
(dry river)	.....C 4
Dahna (desert)	.....D 2
Dawasir, Wadi	.....C 3
(dry river)	.....C 3
Farasan (isls.)	.....C 4
Hasa (reg.)	.....D 2
Hatiba, Ras (cape)	.....D 2
Hejaz (reg.)	.....D 2
Jafura (desert)	.....D 2
Mashabi (isl.)	.....D 2
Midian (district)	.....D 2
Misha'ab, Ras (cape)	.....D 2
Nefud (desert)	.....C 3
Nefud Dahi (desert)	.....C 3
Nejd (region)	.....C 3
Persian (gulf)	.....C 2
Ranya, Wadi	.....C 3
(dry river)	.....C 3
Red (sea)	.....C 3
Rima, Wadi (dry river)	.....C 2
Rub 'al Khali (desert)	.....C 2
Safaniya, Ras (cape)	.....D 2
Salma, Jebel (mt.)	.....C 2
Shaibara (isl.)	.....C 2
Shammir, Jebel (mt.)	.....C 2
Sirhan, Wadi	.....B 1
(dry river)	.....B 1
Subh, Jebel (mt.)	.....D 2
Summan (plateau)	.....D 2
Tihama (plain)	.....C 4
Tiran (isl.)	.....D 2
Tuwaik, Jebel (mt.)	.....D 3

Physical Features

Abu-mad, Ras (cape)	..B 3
'Aneiza, Jebel (mt.)	..B 1
'Aqaba (gulf)	..B 2
Ar Rimal (reg.)	..E 3
'Arafat, Jebel (mt.)	..C 3
Arma (plateau)	..D 2
Asir (reg.)	..C 4
Aswad, Ras al (cape)	..B 3

in modern history. The unit of currency is the riyal, consisting of 100 hallalabs (3.55 riyals equal U.S.\$1; 1975). In 1974 oil revenues were estimated in excess of \$25,000,000,000.

Petroleum. The industry was founded in 1938 by the Arabian-American Oil Company (Aramco) when a productive field was found at Dammam on the Persian Gulf. Aramco was originally owned by four American oil companies, but in 1974 controlling interest was gained by the Saudi government. The country's vast reserves and high level of oil production have made Saudi Arabia a leading producer and a strong voice in the thirteen-member Organization of Petroleum Exporting Countries, which dominates international oil pricing. In 1974 proved reserves were near 132,000,000,000 bbl, and annual production was over 3,000,000,000 bbl. Offshore drilling takes place in the Persian Gulf. The government has also granted exploration concessions to French and Japanese groups. To facilitate the movement of crude petroleum to major markets, the Trans-Arabian Pipeline, known as Tapline, was completed in 1950. It carried crude oil 1068 mi. to Saida, Lebanon, on the Mediterranean Sea. Use of the pipeline was discontinued indefinitely in 1974, as lower-priced surface transportation made shipping from Persian Gulf ports economical.

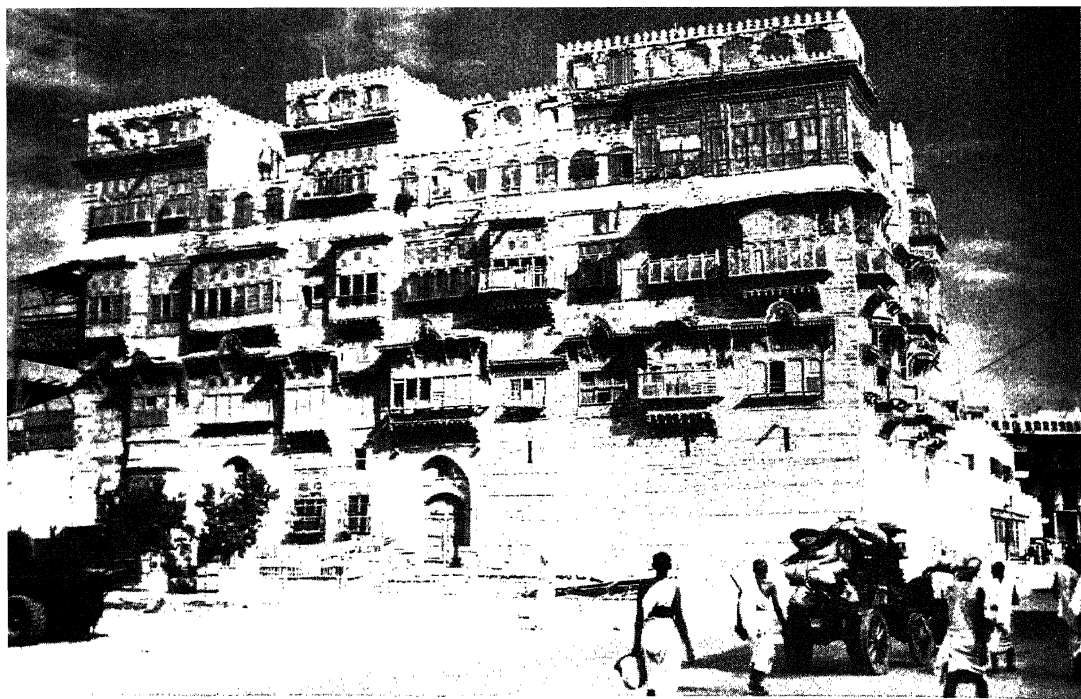
Development Plan. In 1975 the government announced an ambitious five-year development plan, based on continued oil revenues, calling

for expenditures of close to \$140,000,000,000. Priority in the industrial sector was given to the development of a petrochemical industry, to the building of liquefied natural gas plants and other petroleum-based industries, and to steel and cement production to facilitate the large-scale construction required by the plan.

AGRICULTURE. Because in the past the country has had to import much of its food, agriculture is a key area of development. Nearly 75 percent of the population has traditionally been involved in farming and animal husbandry; yet the lack of water has made only some 750,000 acres (about 1 percent of the land area) useful for farming. Irrigated lands near oases have been virtually the only sites of cultivation. The new plan proposes large-scale irrigation projects, desalination of sea water, and the extension of easy credit to farmers in order to stimulate agricultural production. Many of the alien workers and technicians who have been imported to assist in the country's development are engaged in these and other agricultural projects.

Traditionally, Saudi Arabia's leading crop is dates, with over 200,000 metric tons produced annually. Other major crops are wheat, barley, sorghum, fruits, and vegetables. Sheep, goats, and camels are raised in large numbers.

TRANSPORTATION AND COMMUNICATION. The new plan anticipates an additional 8500 mi. of paved highway. The railway system is also being expanded. The 377 mi. line connecting Dammam



The parapeted architecture of a building in Jidda, Saudi Arabia, is typical of that found in Arab cities.

Arabian American Oil Co.

with Riyadh is being extended to Jidda on the Red Sea, and the Hejaz railroad connecting Mecca with Jordan and Syria, a line largely destroyed during World War I, is under reconstruction. (Mecca, birthplace of the prophet Muhammad and Medina, the site of his tomb, both in the Hejaz region, attract hundreds of thousands of Muslim pilgrims from all over the world.) Despite motor vehicles, camels are still an important means of transportation in the desert. Air transportation within Saudi Arabia and to other parts of the Middle East is provided by a government-owned airline. The principal airports are at Dhahran, the site of Aramco headquarters, and at Jidda and Riyadh. Expanded port facilities exist at Dammam, Ras Tannura, and Yenbo. Plans are under way to expand the port facilities of Jidda for pilgrim traffic and for greater commercial usage. Communications facilities include telephone service between Jidda, Mecca, and Taif; domestic and international radio-telephone service; and radio and television broadcasting stations. Some 87,000 radio and 18,000 television sets were in use in the early 1970's. The press consists of 5 dailies, 15 weeklies, and 5 other periodicals.

GOVERNMENT

The Saudi political system is essentially monarchical. In the 1960's, however, it moved toward a mixed monarchical-ministerial type of government. No political parties exist. The king ap-

points a council of ministers which exercises legislative as well as administrative powers. Nevertheless, in practice the king is not an absolute autocrat since he must act on the basis of a consensus among tribal leaders and the royal family. According to the tenets of puritanical Wahhabi Islam, state and religion are considered one, making the king both a governmental and religious leader (imam).

Local Government. Local administration is in the hands of a general municipal council in Mecca, Medina, and Jidda, and district, tribal, and village councils throughout the provinces. Members of all the councils are local leaders who must be approved for office by the king.

Judiciary. The judicial system is based on Islamic law (shari'a) which is derived from the Koran (the holy book of Islam) and the Sunna (traditions) of the prophet Muhammad. Authority to interpret and administer the law is delegated by the king to a chief justice and a supervisory committee, who oversee the courts.

Defense. Since the mid-1960's the defense expenditures of the country have increased dramatically. Saudi Arabia maintains two separate armies. The first is the national guard, or the white guard, which is a conglomeration of tribal levies organized along traditional lines. The regular army is growing rapidly and is being modernized under American and British guidance. Defense personnel total about 51,500.

HISTORY

Saudi Arabia, a union of Hejaz, Nejd, and its dependencies, was formed in 1927 by King Ab-

Saudi Arabia. Plate 1. Right: The Persian Gulf coastal region of Saudi Arabia produces an average of 3,550,000 barrels of petroleum a day. Visible behind the workmen in the picture are huge oil-storage tanks and tall pipes where escaping waste gases are flared. Below: A similar flare-off of waste gases provides a dramatic backdrop for an Arab tending his animals.

Harry Redi-Black Star





George Rodger—Magnum

Saudi Arabia. Plate 2. Above: Bedouins in traditional Arab headdress visit in a tent near an oasis in the Saudi Arabian desert. Below: A square in the old section of Mecca, the religious capital of Saudi Arabia to which Muslim pilgrims travel from all over the world. The city is a study in contrasts, with veiled women shopping in open-air bazaars along streets busy with motor traffic.

Consulate of Saudi Arabia



duh-Aziz ibn-Saud (see *under* IBN-SAUD), who gave his new dominion the name of Saudi Arabia in 1932. For an account of the events leading to the formation of Saudi Arabia, see *ARABIA: History*. Prior to 1938, when large-scale exploitation of Saudi Arabian oil resources began, socioeconomic conditions in the country differed little from those prevailing in antiquity. As royalties from the oil industry increased, King ibn-Saud developed an extensive modernization program, particularly in such areas as water supply, agriculture, manufacturing, and public health. Concurrently ibn-Saud strengthened relations with other states of the Middle East and adopted a friendly policy toward the U.S. and Great Britain. A supporter of the Allied cause in World War II, he permitted construction of a U.S. air base in Dhahran early in the war, but he remained officially neutral until March, 1945, when he declared war on Germany and Japan.

Postwar Period. In 1945 Saudi Arabia joined the United Nations and the Arab League (q.v.). It opposed the creation of Israel but took only a minor part in the Arab League's war of 1948-49 against the new Jewish state. In June, 1951, Saudi Arabia agreed to U.S. use of the Dhahran air base for another five years in return for U.S. technical aid and permission to purchase arms under the Mutual Defense Assistance Act. In December a new agreement with Aramco provided that 50 percent of the company's net earnings should be paid to Saudi Arabia.

King ibn-Saud died on Nov. 9, 1953. He was succeeded by his eldest son, of the same name, ibn-Saud (see *under* IBN-SAUD). In 1954 the government requested discontinuance of U.S. foreign aid. Advocating Arab neutrality in the East-West cold war, Saudi Arabia opposed the Middle Eastern Treaty Organization (METO), formed in 1955 by Turkey, Iraq, Iran, Pakistan, and Great Britain. Representatives from Saudi Arabia attended the Asian-African Conference held April 18-24, 1955, in Bandung, Indonesia. In October, 1955, it signed a mutual-defense pact with Egypt. In the same month British-led forces from the sultanate of Muscat and Oman (now Oman) recaptured an oasis in a disputed area that had been occupied in 1952 by Saudi Arabian police. Saudi Arabia appealed vainly to the U.N. for support against the British. In November King ibn-Saud agreed to lend Syria \$10,000,000 for economic and military purposes. A loan of \$10,000,000 was made to Egypt (now the Arab Republic of Egypt) in August, 1956, when its funds in foreign banks were frozen following the nationalization of the Suez Canal on July 26.

After the joint Israeli, British, and French attack on Egypt in October and November, Saudi Arabia severed diplomatic relations with Great Britain and France and cut off oil supplies to their tankers.

King ibn-Saud visited the U.S. in January, 1957; shortly after the visit it was announced that the U.S. would sell arms and supply other aid to Saudi Arabia in exchange for extension of authority to use the Dhahran air base. Saudi Arabia, in April, and Iraq, in May, declared the Gulf of 'Aqaba to be territorial waters and announced that Israeli ships would be denied passage through the gulf. Despite the declaration, there were no attempts to interfere with Israeli shipping. In February, 1958, King ibn-Saud issued a decree extending Saudi Arabian territorial waters to 12 mi.

In March, 1958, King ibn-Saud transferred legislative and executive powers, formerly included among his own absolute powers, to the prime minister, his brother Crown Prince Faisal (q.v.), while retaining the right of veto. In May a royal decree established a cabinet system and provided that all ministers must be Saudi nationals; until then Syrians and Palestinians had served in government ministries.

Relations with Other Middle-East States. At a conference held in Baghdad from Sept. 10 to 14, 1960, Saudi Arabia, Iraq, Iran, Venezuela, and Kuwait founded the Organization of Petroleum Exporting Countries (q.v.) to coordinate their policies and help sustain oil prices. On Dec. 21,

King Faisal of Saudi Arabia boards an airliner at London during a European tour in 1967.

UPI



SAUDI ARABIA

ibn-Saud reassumed control of the government from Faisal and made himself prime minister.

In October, 1962, King ibn-Saud again relinquished the premiership to Faisal. Meanwhile, Saudi relations with the United Arab Republic (U.A.R.) had been deteriorating. Serious tension developed after the September, 1962, revolution in Yemen; the U.A.R. supported the new republican government, while Saudi Arabia gave refuge to the overthrown Yemeni imam and pledged to support his efforts to regain his throne. After reports of Yemeni royalist attacks against Yemen from Saudi Arabia, the U.A.R. bombed Saudi towns in November, and Saudi Arabia severed diplomatic ties with the U.A.R. and mobilized its armed forces on Jan. 3, 1963.

Prince Faisal, who had been consolidating his power and introducing major social and economic reforms, replaced ibn-Saud as king on Nov. 2, 1964. He designated his brother, Prince Khalid ibn-Abdulaziz (1913-), as his successor.

Arab-Israeli Conflicts. As the Arab-Israeli conflict intensified in May, 1967, King Faisal expressed full support for President Gamal Abdel Nasser (q.v.) and dispatched 20,000 troops to Jordan to face Israel. On June 6 all Saudi Arabian oil exports to Britain and the U.S. were suspended, but diplomatic ties were not broken; the oil trade was resumed after the Arab defeat. An Arab summit conference later in the year resulted in U.A.R. withdrawal from Yemen, and the Saudis extended large-scale financial aid to the U.A.R. to compensate for the loss of revenue caused by the closing of the Suez Canal. King Faisal continued to call for Pan-Islamic action against Israel and, under internal pressures, criticized alleged U.S. complicity with Israel. He remained unwilling, however, to articulate a militant anti-Western position, and in 1971 Saudi Arabia and five other Persian Gulf states concluded a five-year pact with 23 Western oil companies, including 17 American firms. In July, 1970, Saudi Arabia formally recognized Yemen (now Yemen Arab Republic), after seven years of border conflict.

Saudi Arabia sent a small number of troops and weapons (notably aircraft) to aid the Arab states during the October, 1973, Arab-Israeli war. In the aftermath of the war the government, especially petroleum minister Ahmad Zaki al-Yamani (1930-), played a leading role in organizing a short oil boycott against countries that had supported Israel and in quadrupling the international price of petroleum. The latter development, and Saudi Arabia's 1974 takeover of controlling interest in the huge Arabian-American

Oil Company (Aramco), greatly increased government revenue, thus providing funds for a massive economic development plan; see *Economy*, above.

In March, 1975, King Faisal was assassinated by a nephew and was succeeded by Prince Khalid. The king, however, was in poor health, and his half brother, Crown Prince Fahd ibn-Abdulaziz (1920-), became the power behind the throne. The government remained conservative, and Saudi Arabia used its influence to keep the Organization of Petroleum Exporting Countries from raising its prices as much as most of the member countries wanted. (There was a total increase of 10 percent in 1977.) In mid-1977 it was reported that a complete Saudi takeover of Aramco had been negotiated. Many of the "petrodollars" that poured into the country were re-invested in the West or spent on arms, but domestic inflation and a barely manageable pace of development were continuing problems. Saudi Arabia, still considered a moderating force in the Arab-Israeli conflict, did not take an active role in the peace negotiations begun in 1977 between Israel and Egypt (qq.v.).

SAUGUS, town of Massachusetts, in Essex Co., 8 miles N.E. of Boston. It is a residential and industrial town; manufactures include oil products and ventilators. The Saugus Ironworks, built in 1643 and containing one of the first iron forges in America, is now restored to its original appearance. Settled in 1630 as Hammersmith, Saugus was incorporated as a town in 1815. Pop. (1960) 20,666; (1970) 25,110.

SAUL, first king of ancient Israel (r. about 1020-about 1000 B.C.), son of a landowner named Kish, of the tribe of Benjamin (q.v.). The story of his reign is recounted in 1 Sam. 8-15; see books of SAMUEL. The deliverance of the men of Jabesh Gilead (an unidentified city in Gilead, q.v.) and his victories over the Philistines, Ammonites (qq.v.), and Amalekites were proofs of Saul's military capacity. Gradually, however, he began to undergo periods of intense depression, in which he became jealous of David (q.v.), his future successor as king. These periods culminated in paroxysms of insane rage, which led him to attempt David's life with his own hand and to commit such deeds as the massacre of the priests of Nob. Saul fell in a disastrous battle with the Philistines on Mt. Gilboa (in what is now Israel), where his three sons also perished. His fourth son, Ish-bosheth, survived into the 10th century, but was assassinated (2 Sam. 2-4). See also *Jews: The Kingdom*.

SAULT SAINT MARIE, city in Michigan, and county seat of Chippewa Co., on the Saint

St. Marys R., at the Sault Sainte Marie Canals (q.v.), about 80 miles N. of Cheboygan, and opposite Sault Ste. Marie, Canada. The chief products of the city are lumber and veneer. Sault Ste. Marie is in the midst of a resort area. In the city is the house of the American explorer and ethnologist Henry Rowe Schoolcraft (q.v.). The oldest permanent settlement in Michigan, the city dates from 1668, when a mission was founded on the site by the French explorer Jacques Marquette (q.v.). It was incorporated as a village in 1879 and chartered as a city in 1887. Pop. (1960) 18,722; (1970) 15,136.

SAULT STE. MARIE, city and port of s. Ontario, Canada, on the Saint Marys R. at the Sault Sainte Marie Canals (q.v.), opposite Sault Sainte Marie, Mich. Manufactures of the city include steel, forest products, and chemicals. It is also a popular summer resort. The site of Sault Ste. Marie was settled in 1783, when the North West Company built a fur-trading post there. United States troops destroyed much of the settlement during the War of 1812. In the late 1800's Sault Ste. Marie grew as a canal port and railroad center, and it was incorporated as a city in 1912. Pop. (1976) 81,048.

SAULT SAINTE MARIE CANALS, popularly called SOO CANALS, two canals in N.E. Michigan and one canal in s. Ontario, Canada. The canals, all toll-free, are in the Saint Marys R., which connects Lake Superior and Lake Huron. On opposite banks of the river are Sault Sainte Marie, Mich., and Sault Ste. Marie, Ontario.

The U.S. waterways, both about 2.8 km (1.75 mi.) long, have four parallel locks. The North Canal includes Davis lock (opened 1914) and Sabin lock (1919), and the South Canal includes MacArthur lock (1943) and Poe lock (1969). The Canadian canal, 2.1 km (1.3 mi.) long, has one lock (1895). The canals allow ships to navigate a section of the Saint Marys R. made hazardous by a 1.2-km (0.75-mi.) stretch of rapids and a substantial drop in the level of the river (as much as 6.4 m/21 ft.) from the elevation of Lake Superior to that of Lake Huron.

The great bulk of the cargo carried through these busy canals, which are closed by ice from mid-November to April, is eastward bound. Most of this cargo is iron ore and grain. The chief goods shipped w. are coal and petroleum. More than 90 percent of the total freight is shipped via the U.S. facilities.

The first canal in the Saint Marys R. was opened on the Canadian side in 1798. It was destroyed during the War of 1812. A U.S. canal was completed by Michigan in 1855. It was taken over by the Federal government in 1881

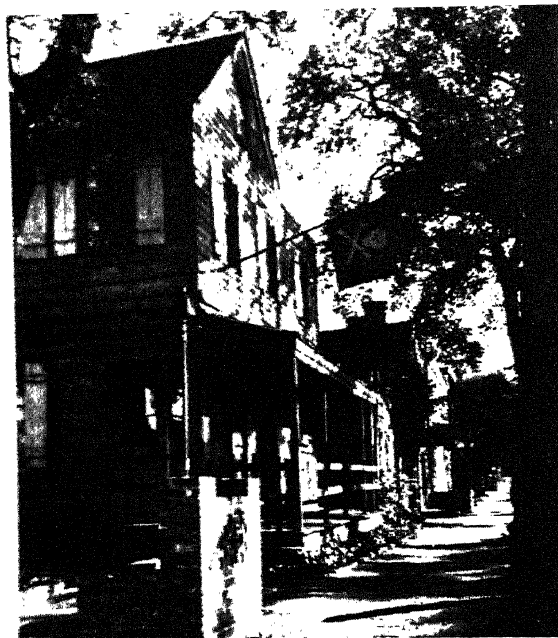
and formed the basis for the present U.S. waterways.

SAVA or SAVE, river in Yugoslavia, an important affluent of the Danube R. It rises in the Julian Alps in N.W. Yugoslavia, and flows S.E., joining the Danube at Belgrade. It is about 584 mi. long, and is navigable for about 350 mi.

SAVANNA or SAVANNAH, grasslands of the tropics and subtropics. Savannas are abundant in Africa and South America, especially in Brazil, where they are called campos, and Venezuela, where they are called llanos. The grasses of the savannas undergo a heavy rainy season, but are also subject to long periods during which no rain falls; consequently, in order to thrive in savannas, the grasses must be both resistant to drought and able to endure periods of heavy inundation. The height of the grasses on a savanna varies with the amount of moisture in the soil. Small, scrubby trees are characteristically present on savannas but are inhibited from multiplying by the long dry season. Although savanna soil has low fertility, regions with a relatively short dry season can be reclaimed for agricultural purposes by careful artificial fertilization. The term "savanna" is also applied to the treeless prairies of the S.E. United States.

SAVANNAH, city and port in Georgia, and county seat of Chatham Co., on the Savannah R., about 17 mi. from the Atlantic Ocean, and about 220 miles S.E. of Atlanta. Transportation facilities include railroads, highways, ships, and a municipal airport. Savannah is the leading seaport in the State, the second largest city in population, and one of the principal commercial and industrial centers. Major industries include fishing, food processing, fertilizer processing, and the manufacture of chemicals, lumber, paper, and fabricated metals. Savannah is one of the leading markets and shipping points in the United States for naval stores. Paper, peanuts, tobacco, and cotton are also exported.

Savannah is one of the most beautiful cities of the South and is of considerable historic interest. The streets are broad and well shaded, and are interspersed with numerous parks. Points of interest in the city and vicinity include Christ Episcopal Church, built in 1838, but organized as a congregation in 1733; Hodgson Hall, containing the library and historical museum of the Georgia Historical Society; and the Telfair Academy of Arts and Sciences, containing an excellent art gallery. Also in the city are the birthplace of Juliette Low (1860-1927), founder of the Girl Scouts in America, and several fine antebellum houses. Educational institutions include Savannah State College, founded in 1890.



The Pirates' House, in Savannah. Built in 1754 as an inn for visiting seamen, it soon became a rendezvous for buccaniers.
Georgia Dept. of Industry & Trade

History. Savannah, the first permanent European settlement in Georgia, was founded in 1733 by the British colonizer James E. Oglethorpe (q.v.). It served as the seat of government for the royal colony of Georgia, created in 1754. The British captured the town during the American Revolution, holding it from 1778 to 1782. In 1779 a force of French and Americans attempted to retake the town but were defeated with heavy losses. From 1782 to 1785 Savannah was the capital of the State of Georgia. It was chartered as a city in 1789. Savannah became an important port and in 1819 the *Savannah*, first steamship to cross the Atlantic Ocean, sailed from Savannah to Liverpool, England. During the Civil War the city was an important supply depot for the Confederate forces and was the goal of the march to the sea led by the Union general William Tecumseh Sherman (see under SHERMAN). Savannah fell to Sherman's forces on Dec. 21, 1864; see CIVIL WAR, THE AMERICAN. Pop. (1960) 149,245; (1970) 118,349.

SAVANNAH, river constituting most of the boundary between Georgia and South Carolina. It is formed by the junction of the Tugaloo and Seneca rivers in N.W. South Carolina and flows S.E. until it enters the Atlantic Ocean near Savannah, Ga. It is about 314 mi. long and is navigable by small boats from the Atlantic to Augusta, Ga.

SAVE. See SAVA.

SAVINGS AND LOAN ASSOCIATIONS. See SAVINGS INSTITUTIONS: *Savings and Loan Associations.*

SAVINGS INSTITUTIONS, banks or associations established for the encouragement of personal thrift, through deposit of individual or family savings, and of general profit, through investment or interest (q.v.). See BANKS AND BANKING. In the United States, types of savings institutions include mutual savings banks, stock savings banks, savings and loan associations and government savings bonds.

Mutual Savings Banks. Mutual savings banks are institutions that promote savings deposits by individuals, invest these savings in residential housing mortgages (see MORTGAGE) and corporate and government securities, and offer additional banking services to individuals and families. They hold about one eighth of all American bank deposits, these accounts amounting to approximately \$67,086,000,000 at the end of 1969; more than 60 percent of this total was held by New York State savings banks.

Mutual savings banks have no stockholders and their assets are administered for the sole benefit of present and future depositors, with earnings paid to such depositors after meeting expenses and setting aside reserves for depositors' protection; see FEDERAL DEPOSIT INSURANCE CORPORATION. The banks are managed by trustees who are community leaders active in business, the professions, and industry. These banks have evolved into financial institutions offering a wide variety of family money-management services. The most important of these are time deposits on which a fixed rate of interest is paid for up to five years; student, home-improvement, and passbook loans; banking by mail; life insurance (see INSURANCE); and school savings programs.

The first mutual savings bank was established in Ruthwell Village, Scotland, in 1810, the conception of the Reverend Henry Duncan (1774-1846), who attempted to relieve the poverty of his congregation by providing a means of ready saving of small sums. The idea was adopted in 1816 in the U.S. with the formation of two savings banks, one in Boston, Mass., and the other in Philadelphia, Pa. Both of these founding banks continue in operation today.

Stock Savings Banks. Institutions that operate like any other corporation and pay their profit to shareholders are called stock savings banks. They are comparatively few in number and have only slight influence upon the national economy. A type of institution known as a Savings Bank and Trust Company holds a strong position, however, particularly in the West. Many other commercial banks also accept savings deposits. See STOCK EXCHANGE.

Savings and Loan Associations. Financial institutions devoted almost wholly to thrift and home ownership are known as savings and loan associations. They represent the third largest financial institution system in the U.S., being out-ranked by commercial banks and life insurance companies. The associations have contributed to the fact that 64 percent of American families in 1970 were homeowners. Depending upon location in the U.S., such associations are also known variously as building and loan associations, building associations, homestead associations, or cooperative banks; see COOPERATIVE MOVEMENT; HOMESTEAD LAWS. By law, however, the "savings and loan" name is required usage for all Federally chartered associations, which represent more than one half of the assets of the business.

The American savings-and-loan business began in Frankfort, Pa., in 1831 with the founding of the Oxford Provident Building Association, which was patterned after the British building societies of the day. In 1831, most of the associations were of the terminating type; that is, their sole purpose was to enable members to buy a home. Each member would deposit a monthly payment, and the institutions were set up so that this would provide a home to one member per month. The member who was granted a mortgage then paid monthly installments until his debt was satisfied. The terminating associations stayed in business until all the members had received funds to build a home of their own and then usually dissolved.

An outgrowth of the terminating associations was the similar serial association. In these organizations members were admitted on a quarterly, semiannual, or annual basis, but the organization was continuous. Many of these associations began to accept members who wanted to save, but not necessarily to buy a home. Borrowers were charged interest on a loan; the savers were given back their contribution plus earnings at the completion of their contract. This was the beginning of the savings-and-loan business as it is known today. The next step was the organization of permanent associations. These institutions accepted members from day to day and paid earnings in either regular installments or at the member's option, financing homes and charging interest in the same manner as today. The growth of serial and permanent associations was considerable between 1900 and 1930.

In 1933, during the severe depression (see BUSINESS CYCLE), Congress authorized the chartering, examination, and supervision by the Fed-

eral government of Federal savings and loan associations. Similar to mutual savings banks, these associations accept savings and investment funds, and, in turn, lend the funds in the form of mortgages. By law, approximately 80 percent of loanable funds of associations are channeled into monthly amortized home mortgages, that is, for single-family residences and two- to four-family apartments. Such loans must be made in most cases within a 100-mi. radius of the association's principal office. Most of the remaining 20 percent of loans can be made on multiunit dwellings and other types of improved real estate such as hotels, motels, shopping centers, and industrial parks. The associations are authorized to invest in government bonds without limit. Most State-chartered associations operate on a similar basis.

The volume of savings-and-loan business in the post-World War II period has been unprecedented. In 1950 there were 1526 Federal associations and 4466 State-chartered associations, making a total of 5992 institutions; combined assets of the entire system were \$16,900,000,000. In 1972 there were 5544 Federal associations and State-chartered institutions, with year-end assets being \$206,300,000,000.

Savings deposits in savings and loan associations amounted to \$175,000,000,000 in 1972; this compared to \$181,900,000,000 and \$67,000,000,000 in commercial banks and mutual savings banks, respectively, in 1969. All savings accounts in insured savings associations are insured up to \$20,000 by the Federal Savings and Loan Insurance Corporation, an agency of the U.S. government; it is operated in the same manner as the Federal Deposit Insurance Corporation (see *Mutual Savings Banks*, above).

On the lending side of the savings-and-loan business, the record has been equally spectacular. In 1940 savings-and-loans made 22.5 percent of the mortgages on basic one- to four-family dwellings, and by 1972 the savings-and-loan share of this market had risen to about 51 percent. Most mortgages made by savings and loan associations are of the conventional type, that is, involving no government guarantees and made at the lender's own risk. In 1972, 72.6 percent of savings-and-loan mortgages were conventional; 6.7 percent were insured by the Federal Housing Administration (q.v.); and 5.3 percent were guaranteed by the Veterans Administration (q.v.).

Federal Savings Bonds. Federal savings bonds provide the government with collateral for national expenditures and accrue interest for the purchasing citizen upon redemption after a

SAVONA

given period; see **BOND**. War bonds, known as Liberty bonds, were issued during World War I. The issuing of government savings bonds reached its greatest volume during World War II with the sale to the American public of Series E war bonds. A large percentage of these savings certificates was sold through regular, periodic deductions from employee payrolls. Still issued today, Series E bonds are available in denominations of \$25, \$50, \$100, \$500, and \$1000.

See also **INVESTMENT BANKING**; **INVESTMENT COMPANY**; **TRUST COMPANIES**.

SAVONA, city and port of Italy, in Liguria Region, and capital of Savona Province, on the Gulf of Genoa, about 26 miles s.w. of Genoa. The city's harbor is used mainly as a port of entry for coal needed by industries in the region. Industrial establishments in the city include iron foundries, mechanical-engineering plants, textile factories, and pottery, soap, and glass works. Savona has a Renaissance cathedral, built between 1589 and 1604, a 14th-century tower, and an art gallery featuring 15th- and 16th-century Genoese works. Pop. (1971) 79,618.

SAVONAROLA, Girolamo (Jerome) (1452–98). Italian preacher and reformer, born of a noble family in Ferrara. In 1474 he entered the Dominicans (q.v.), in Bologna. He made his first appearance as a preacher in 1482, in the priory of San Marco, the Dominican house in Florence. His preaching centered increasingly on the sinfulness of the time, and he openly attacked the corrupt aristocratic adherents of the Medici (q.v.) family.

A Political Preacher. In 1493 his proposed reform of the Dominican order in Tuscany was approved by the pope, who named Savonarola its first vicar-general. His preaching was now political. In one of his discourses he pointed plainly to the coming ascendancy of the French led by Charles VIII, King of France (see *under* CHARLES). When this prediction was fulfilled by the appearance of the French invasion forces in 1494 Savonarola helped to welcome Charles to the city. When the French left Florence, a republic was established from which the Medici were excluded, and Savonarola became, although without political functions, its guiding and animating spirit.

During this brief tenure of influence Savonarola displayed both his extraordinary genius and the extravagance of his ascetic theories. The republic of Florence was to be the model of a Christian commonwealth, and stringent enactments were made for the repression of vice.

Growing Unpopularity. His denunciations did not spare even the pope, Alexander VI (see



Girolamo Savonarola, portrait by the Italian Renaissance painter Fra Bartolommeo.
Bettmann Archive

under ALEXANDER). Together with the attribution to Savonarola of a supernatural gift of prophecy and his extravagant interpretation of the Scriptures, these denunciations drew upon him the displeasure of Rome. He was cited, in 1495, to answer a charge of heresy (q.v.). On his failure to appear in Rome, he was forbidden to preach, and the brief by which the Florentine branch of his order had been made independent was revoked. He indignantly refused the pope's attempts at conciliation and was again forbidden to preach, an order he disregarded.

Meanwhile his difficulties at home began to deepen. The measures of the new republic proved impracticable. The party of the Medici, called *Arrabbiati* (It., "Enraged"), began to recover ground, and a conspiracy was formed to support them. Five of the conspirators were executed, which only served to hasten the reaction against Savonarola. The execution of these conspirators was afterward charged to Savonarola.

At the critical point of the struggle, in 1497, came a sentence of excommunication from Rome. Savonarola openly declared the censure invalid and refused to hold himself bound by it. During an outbreak of the plague (q.v.) Savonarola, prevented by the excommunication from administering the sacred offices, devoted himself zealously to ministering to the sick monks.

In 1498 he was declared guilty of heresy and of seditious teaching and sentenced to death. The same record was sent to Rome, where the sentence was confirmed. Savonarola, with two members of his order, was given up to the secular power. Then, on May 23, 1498, after he had administered the last communion (see *LAST SUPPER*), to his two companions and himself, the three were hanged and their bodies burned.

SAVOY, former duchy lying between Italy and France (see *SAVOY, HOUSE OF*), and region of present-day France, comprised of the departments of Savoie and Haute-Savoie. Savoy is situated in the southwestern Alps. On the N. it is bordered by Lake Geneva, and on the W. it is bounded partly by the Rhône R., whose affluents drain the region. In the S.E. the Graian Alps separate Savoy from the Piedmont Region of Italy. The summit of Mt. Blanc, the highest peak of the Alps, is within the borders of Savoy. In the region are several lakes, among them Bourget and Annecy, and a number of mineral springs, the most noted of which are those of Aix-les-Bains and Saint-Gervais-les-Bains. The largest town in the region is Chambéry.

SAVOY, HOUSE OF, dynasty of western Europe. The house was founded by a Burgundian nobleman, Humbert the Whitehanded (d. about 1048?). Humbert's son Oddone (d. 1060) succeeded to the title of count of Savoy, and by his marriage to Adelaide (d. 1091), heiress of Turin in Piedmont (q.v.), he greatly extended his dominions. In the succeeding three centuries the possessions of the family were greatly enlarged in France, Italy, and Switzerland. In the 13th century Nice was secured, giving Savoy an outlet to the sea. Amadeus of Savoy, later the antipope Felix V (see *under FELIX*), by his support of Sigismund (q.v.), Holy Roman Emperor, secured the creation of the duchy of Savoy in 1416 and became the 1st duke of Savoy. In 1434 he handed over much of his authority to his son Louis (d. 1465) and founded a religious order. In 1440 he became an antipope.

By 1536 the authority of the dukes of Savoy over Geneva had ended, and they were dispossessed of their Swiss territories. In 1536 Francis I (q.v.), King of France, seized the dominions of the house of Savoy. In 1559, however, most of the duchy was restored to Emmanuel Philibert, 10th Duke of Savoy (1528–80) by the Treaty of Cateau-Cambrésis.

Victor Amadeus II (1666–1732) was compelled for a time to submit to various French demands but finally joined the Grand Alliance (q.v.) against France. By the Treaty of Turin in 1696, Savoy made a separate peace with France and

detached itself from the Grand Alliance. After Victor Amadeus joined Austria (q.v.) in the War of the Spanish Succession (see *SPANISH SUCCESSION, WAR OF THE*) in 1703, the French overran and devastated Piedmont, but were defeated by Victor Amadeus and his cousin, the Austrian general Eugene, Prince of Savoy (q.v.), at the siege of Turin in 1706. Victor Amadeus in 1713 by the Peace of Utrecht (see *UTRECHT, PEACE OF*) was accorded possession of Sicily with the title of king. The alliance with Austria also added to Savoy the remainder of Montferrat, part of the region having already been ceded to the duchy in 1631. Sicily was given to Austria in 1720 in exchange for Sardinia, and Victor Amadeus became king of Sardinia. In 1831 Charles Albert (1798–1849) of Savoy Carignan became king of Sardinia. In 1849 he abdicated in favor of his son Victor Emmanuel II (see *under VICTOR EMMANUEL*), who in 1860 ceded Savoy and Nice to France and in 1861 assumed the title of king of Italy. He was succeeded in 1878 by Humbert I (q.v.), who was assassinated in 1900. The latter's son Victor Emmanuel III (see *under VICTOR EMMANUEL*) abdicated in May, 1946, in favor of the crown prince, Humbert II (1904–), who ruled until June, 1946, when Italy became a republic. Victor Emmanuel III, Humbert, and Humbert's heir Victor Emmanuel (1937–) moved to Portugal shortly thereafter.

SAWATCH, mountain range in Eagle, Lake, and Chaffee counties, Colo., a branch of the Rocky Mts. The range extends for about 110 mi. and reaches a height of 14,433 ft. at Mt. Elbert, the highest point in the State.

SAWFISH, common name applied to rays constituting the family *Pristidae*; see *RAY*. These cartilaginous elasmobranch fish differ from most rays in being rather narrow. They bring forth their young alive; their chief distinction is the possession of an elongate, cartilaginous snout, which attains a length of almost 6 ft., and which is studded on each side with strong tooth-like projections, each of which is about 1½ in. long. The sawfish uses this structure as a weapon with which to slash disturbers and also obtain food. Adult sawfish attain a total length, including saw, of from 10 to 20 ft. They inhabit the shallow regions of tropical seas, being especially abundant off tropical America and Africa. The common sawfish found from the Gulf of Mexico southward is *Pristis pectinatus*.

SAWFLY, common name applied to the four-winged, hymenopterous insects constituting the family *Tenthredinidae* and several small related families. The sawflies are widely distributed in temperate countries. The insects derive their

name from the fact that portions of the ovipositor or egg-laying organ of the female are modified into sharp-toothed, sawlike instruments with which the female incises leaves and plant stems to form a receptacle for eggs. Female sawflies do much damage to plants; greater damage is done by the voracious larvae that are capable of completely stripping a plant of its leaves. The larvae, which are commonly but erroneously called slugs, somewhat resemble butterfly caterpillars, differing in having a single simple eye or ocellus on each side of the head, in lacking sharp hooklets on the legs, and in usually being coated with slime. When feeding on leaves, they assume a characteristic position in which the posterior end of the body is not in contact with the leaf but is coiled downward, hanging in space. When disturbed, the larvae of some species eject a fluid from the head region. Most of the larvae pupate underground inside a cocoon (q.v.). Among the well-known American sawflies are the cherry or pear slug, *Eriocampoides limacina*, which feeds on the leaves of cherry and pear trees, and the rose slug, *Cladius isomerus*, which feeds on the leaves of rose bushes. The currant sawfly, *Pteronidea ribesii*, which is about $\frac{1}{4}$ in. long, has spread to the United States from its native Europe; its larva destroys currant bushes. The larch sawfly, *Nematus erichsonii*, deposits its eggs in the leaves of larch trees, which the larvae defoliate. The largest of the common sawflies is *Cimbex americana*, which is about 1 in. long and has a wingspread of about 2 in.; the larva of this species feeds on the leaves of many trees, especially of willow. Compare HORNTAIL.

SAX, Antoine Joseph, known as ADOLPHE SAX (1814–94), Belgian inventor of musical instruments, born in Dinant. His father, the Belgian musical-instrument-maker Charles Joseph Sax (1791–1865), sent him to the Brussels Conservatory where he studied flute and clarinet. Adolphe Sax is chiefly known for the invention of the saxophone (q.v.), about 1840, which was patented in 1846. Ambitious for recognition for his various wind instruments, he went to Paris in 1842, where his instruments won notice at several expositions between 1844 and 1867. Among his other inventions were the saxotrompa and saxhorn (q.v.), both of which he registered in 1845. Conservative music critics ridiculed his instruments, but they were adopted by French military bands and praised by numerous prominent figures, including the French composer Louis Hector Berlioz (q.v.). Sax became an instructor in the saxophone at the Paris Conservatory in 1857. Although the saxophone fell out of

favor after his death, the advent of jazz (q.v.) in the early 20th century reinstated it as a universal musical instrument.

See MUSICAL INSTRUMENTS: *Wind Instruments*.
SAXE-ALTENBURG, former duchy of Germany. See THURINGIA.

SAXE-COBURG-GOTHA, former duchy of Germany. The town of Coburg was acquired about the end of the 14th century by a German family named Wettin, whose members later became electors of Saxony (q.v.). Upon the partition of the Wettin lands in 1485 the town fell to the Ernestine branch of the family. In 1735 Coburg was acquired by the Duchy of Saxe-Saalfeld, which thus became the Duchy of Saxe-Coburg-Saalfeld, with Coburg as its capital. In 1826 the ruler of this duchy, Duke Ernest III (1784–1844), ceded the town of Saalfeld to the Duchy of Saxe-Meiningen, receiving Gotha in exchange, and henceforth called himself Ernest I of Saxe-Coburg-Gotha. Saxe-Coburg-Gotha joined the North German Confederation (q.v.) in 1866 and in 1871 became a member of the German Empire. In 1919 Saxe-Gotha was included in the new State of Thuringia (q.v.), and Coburg became a part of the State of Bavaria (q.v.). After the conclusion of World War II, Thuringia was included in East Germany and Bavaria in West Germany. See GERMANY: *History*.
SAXE-MEININGEN, former duchy of Germany. See THURINGIA.

SAXE-WEIMAR-EISENACH, former duchy of Germany. See THURINGIA.

SAXHORN, three-valved musical instrument of the brass group developed by the Belgian instrument maker Antoine Joseph Sax (q.v.) between 1842 and 1845. The metal tubing of a saxhorn dips down from a horizontal section into a series of coils and ends in a wide bell. Valve pistons are located on the horizontal part of the tube, and a cup-shaped mouthpiece is fixed to its end. The saxhorn is held upright against the body when played. A somewhat narrow, conical bore gives the instrument a brilliant tone, brighter than that of the bugle (q.v.). Saxhorns are made in seven different sizes, with an ascending range of tone from the largest to the smallest. These fall into two groups: four instruments of high pitch and three of low pitch (see PITCH). The low-pitched instruments are generally considered as belonging to the tuba (q.v.) family. The total range of all seven is about four and a half octaves. Saxhorns are normally used only in brass bands. See MUSICAL INSTRUMENTS: *Wind Instruments*.

SAXIFRAGACEAE (Lat. *saxum*, "rock"; *frangere*, "to break"), name applied to a family and

to a genus of hardy, perennial herbs and low shrubs, so called because many of them grow in the crevices of rocks. The Saxifrage family, which contains about 90 genera and about 600 species, is chiefly indigenous to the temperate and cold countries of the New World and Eurasia. Many members of the family are cultivated, especially in rock gardens. Plants in the Saxifrage family sometimes have opposite leaves. Their white, yellow, or purplish flowers, which are usually borne in panicles or racemes, have a five-lobed calyx, five petals, five to ten stamens, and a solitary pistil. The fruit is either a two-beaked, two-celled capsule or a one-celled follicle. See MITERWORT.

The saxifrages proper, also known as rock-foils, belong to the genus *Saxifraga*. The genus contains about 400 species, 85 of which are native to North America, and about 200 of which are commonly cultivated. Saxifrages are easily grown, thrive in poor, well-drained soil, and are extremely resistant to disease. Beefsteak saxifrage, *S. sarmentosa*, which is also known as the strawberry geranium, Aaron's-beard, old-man's-beard, and mother-of-thousands is commonly cultivated in gardens throughout the U.S.; this dwarf plant, which has white flowers spotted with yellow and red, is often grown in window boxes for cut flowers. Among other well-known saxifrages are the London pride or Saint-Patrick's cabbage, *S. umbrosa*; the crimson moss, *S. decipiens*, a mossy plant with foliage which turns crimson in late fall; the meadow saxifrage, *S. granulata*, which has single or double flowers measuring about 1 in. in diameter; the swamp saxifrage, *S. pennsylvanica*, which bears small greenish or reddish flowers; and the mountain saxifrage, *S. oppositifolia*, which has purple flowers.

SAXO GRAMMATICUS (1150?–1220?), Danish historian. He was secretary to the Danish archbishop Absalon (q.v.) who, according to tradition, suggested that Saxo write a chronicle of early Danish history. His *Gesta Danorum* ("Deeds of the Danes"), or *Historia Danica*, recounts the history of Denmark until about 1185 in sixteen books. According to Saxo's own statement, he derived his knowledge of early Danish history from old songs, runic inscriptions, and historical traditions. Although early portions of the chronicle are not authoritative, the work is regarded as accurate as to events of the writer's own times. Among the stories recounted by Saxo is that of the Danish prince Amleth, or Hamlet (q.v.), the original source for the play of that name by the English playwright William Shakespeare (q.v.).

SAXONS, Germanic people who first appear in history after the beginning of the Christian era. The earliest mention of the Saxons is by the Egyptian mathematician and geographer Ptolemy (q.v.) in the 2nd century A.D., at which time they appear to have dwelt in the south Jutland Peninsula in the north of what is now West Germany. They conducted piratical raids in the North Sea area, and in the 3rd and 4th centuries they pressed southward into the region of the Weser R., where they encountered the Chauci and the Angrivarii, Germanic tribes that they subdued and absorbed. In the second half of the 4th century, the Saxons invaded Roman domains, and by the close of the 6th century all northwest Germany as far east as the Elbe R. had become Saxon territory. In the 5th and 6th centuries some groups of Saxons invaded Britain, where they were joined by other Germanic peoples, the Angles (q.v.) and the Jutes (see JUTLAND). At the beginning of the 7th century the Anglo-Saxon conquest of Britain was practically completed; see ENGLAND: *History*. In the 8th century, the Frankish king Pepin the Short (see under PEPIN) attacked the Saxons who remained in Germany. His son Charlemagne (q.v.) subdued them after a series of fierce wars lasting from 772 to 804 and forced them to accept Christianity. In the course of the 9th century a great Saxon duchy came into existence under Frankish sovereignty. This old duchy of Saxony (q.v.) was dissolved toward the end of the 12th century, and the name of Saxony later passed over to an entirely different region. See GERMANY: *History: Holy Roman Empire*.

SAXONY (Ger. *Sachsen*), name of several former geographic and political units in East Germany and West Germany. Saxony originally referred to the region in N.W. Europe inhabited by the Saxons (q.v.), a Germanic tribe first appearing in history in the 2nd century A.D. In 772 Charlemagne (q.v.), King of the Franks and later Holy Roman Emperor, invaded the land of the Saxons. During the 9th century his descendants created the powerful duchy of Saxony in Saxon territory. Extensive areas were added to the duchy by Henry the Fowler, who became Henry I (q.v.), King of Germany, in 919. In 962 Henry's son Otto I (see under OTTO) was crowned Holy Roman Emperor. In 1180 Frederick I (q.v.), Holy Roman Emperor, dissolved the duchy of Saxony in retaliation against its defiant duke, Henry the Lion (q.v.). At its height, the duchy had extended westward almost to the Rhine R. and as far east as the Oder R.

Early History. The ducal possessions were distributed among various princes and bishops; the



Submission of the Saxons to Charlemagne, who forced them to accept Christianity.

title and a small district between the Elbe and Weser rivers were given to Bernhard of Anhalt (d. 1212). In 1356 the duchy of Saxe-Wittenberg, one of two duchies created in the preceding century when Bernhard's grandsons split the family possessions, was granted the electoral privilege and became known as Electoral Saxony; see ELECTORS, GERMAN IMPERIAL; GOLDEN BULL. Upon the death of the last of Bernhard's descendants in 1423 Sigismund (q.v.), Holy Roman Emperor, conferred Electoral Saxony, together with the electoral privilege, on Frederick I, Margrave of Meissen (1370–1428).

Frederick established his family of Wettin as the ruling house of Saxony and brought to his new realm vast holdings in central Germany, including Thuringia (q.v.). In 1485 the possessions of the House of Wettin were divided between Frederick's grandsons, Ernest (1441–86) and Albert III (1443–1500). Ernest retained Saxe-Wittenberg and the electoral privilege; Albert's holdings in Meissen became a duchy. The Albertine duchy gained the ascendancy in 1547 when Maurice, Duke of Saxony (1521–53), sup-

ported Charles V (q.v.), Holy Roman Emperor, against the confederation of Protestant German princes known as the Schmalkaldic League (q.v.). The emperor transferred to Maurice the electoral privilege and most of the electoral domains of the Ernestine dukes. In 1552 Maurice, a Protestant, broke with Charles V and succeeded in forcing the Catholic emperor to withdraw from Germany. The expanded electorate of Saxony, with Dresden as its capital, subsequently became a Protestant stronghold.

In the 17th and 18th centuries Saxony was directly involved in the religious and territorial struggles ravaging Europe. During the Thirty Years' War (q.v.), her allegiance wavered between the Holy Roman emperor and the opposing Protestant forces of Sweden. In 1697 Frederick Augustus I, Elector of Saxony (1670–1733), became Augustus II, King of Poland. In the next century Saxony became party to the War of Austrian Succession when Elector Frederick Augustus II, who was also Augustus III (q.v.), King of Poland, laid claim to the throne of Austria; see SUCCESSION WARS. At first Saxony was allied with France, Spain, Prussia, and Bavaria against Austria, Hungary, and Great Britain; in 1742, how-

ever. Frederick Augustus reversed himself and sided with Austria. In 1756 Saxony was invaded by the forces of Frederick II (q.v.), King of Prussia at the beginning of the Seven Years' War (q.v.). Elector Frederick Augustus fled to Poland. Although her boundaries remained unchanged, Saxony was immeasurably weakened.

19th Century. In 1806, during the Napoleonic Wars (q.v.), Frederick Augustus I, Elector of Saxony (1750–1827) fought the French. Napoleon I (q.v.), Emperor of France, following his victory at Jena in Saxon territory, forced Saxony to join the Confederation of the Rhine (q.v.). Frederick Augustus then joined Napoleon as an ally and was permitted by the French emperor to proclaim himself Frederick Augustus I (q.v.), King of Saxony. In 1815, after the downfall of Napoleon I, the kingdom of Saxony was partitioned at the Congress of Vienna; see VIENNA, CONGRESS OF. By the terms of the partition, Prussia acquired more than half of the Saxon territory, which thereafter became the Prussian province of Saxony.

The now attenuated kingdom of Saxony was allied with Austria against Prussia in the Seven Weeks' War (q.v.) of 1866. The victorious Prussians levied a heavy cash indemnity on Saxony and forced it to join the North German Confederation (q.v.). In 1871 Saxony became one of the constituent kingdoms of the newly organized German Empire.

20th Century. In 1918, two days before the German surrender in World War I (q.v.), an uprising forced the abdication of Frederick Augustus III (q.v.), King of Saxony, and a republic was proclaimed. The Saxon Republic became one of the founding States of the German Republic in February, 1919. Following the defeat of Germany in World War II (q.v.), the State of Saxony was liquidated. All of its former territory and that part of the former Prussian province of Silesia (q.v.) w. of the Neisse R. was constituted a State in the Soviet occupation zone of Germany. This State was dissolved as a political and administrative entity in 1952, when East Germany was divided into smaller administrative units called districts.

The present State of Lower Saxony (q.v.) of the Federal Republic of Germany (West Germany) was formed in 1946 from the former German States of Brunswick, Oldenburg, and Schaumburg-Lippe and the Prussian province of Hannover.

SAXOPHONE, name of a family of eight musical instruments combining characteristics of the woodwind and brass instruments, and developed by the Belgian instrument maker Antoine



Alto saxophone

Cloetingh & Derran Studios

Joseph Sax (q.v.) about 1840. The saxophone combines in its construction the conical bore of the oboe, the single reed and mouthpiece of the clarinet (qq.v.), and a metal body. The body contains twenty openings, covered by keys, which can be opened or closed in groups by means of six studs, or finger plates, operated by the first three fingers of either hand. Two additional holes called pipes or speakers are used to produce notes an octave above or below the normal range. Most saxophones are curved at the end, and resemble the bass clarinet; a few, particularly some types of soprano saxophone, are straight, and resemble the standard clarinet. The most common types of saxophone are the soprano, the alto, the tenor, and the baritone. The tone quality of saxophones is varied, including soft, flutelike tones, mellow tones comparable with those of the cello, and metallic tones similar to those of the brass instruments.

Saxophones were first introduced into the symphonic orchestra by the German composer and teacher Johann Georg Kastner (1810–67) in his Biblical oratorio *The Last King of Judah* (1844). Subsequently, parts for saxophones were written by the German composer Giacomo Meyerbeer, the French composers Louis Hector Berlioz and Georges Bizet (qq.v.), and others. The German composer Richard Strauss (q.v.)

SAYREVILLE

used a quartet of saxophones in his *Sinfonia Domestica* (1903). Notable solo works for the saxophone include a *Rhapsody* (1903) for saxophone and orchestra by the French composer Claude Debussy and *Fantasia for Saxophone and Orchestra* (1946) by the Brazilian composer Heitor Villa-Lobos (q.v.). In military bands, saxophones are usually used instead of clarinets. In the late 20th century, saxophones were used less frequently in orchestras and were popular mainly in the United States, where they were particularly associated with the development of jazz (q.v.). Saxophones made of plastic materials were introduced with success by some jazz musicians.

See MUSICAL INSTRUMENTS: *Wind Instruments*.

SAYREVILLE, borough of New Jersey, in Middlesex Co., on the Raritan R., about 5 miles S.E. of New Brunswick. In the borough and vicinity are extensive clay deposits. Sayreville is an important brick-manufacturing center, and also has plants producing explosives, chemicals, and cooking equipment. Sayreville was incorporated in 1919. Pop. (1960) 22,553; (1970) 32,508.

SCAB. See DISEASES OF PLANTS.

SCABIES. See ITCH.

SCABIOUS, extensive genus, *Scabiosa*, of herbaceous plants, exclusively native to the Eastern Hemisphere, in the family Dipsacaceae. The flowers are collected in terminal heads, surrounded by a many-leaved involucre, like flowers in the Composite family, Compositae.

SCALA, LA. See LA SCALA.

SCALE (It. *scala*, "ladder"), in music, arrangement in orderly patterns, according to rising or falling pitch (q.v.), of the chief tones accepted in a musical system. No complete record exists of all the scales that have existed in the past. The scales most commonly used in Western music since the 17th century are the diatonic major and minor. The diatonic scales consist of a series of seven tones arranged within an octave (q.v.). An eighth tone, sometimes called the "final", is used to complete the scale; it is identical to the initial tone, but one octave higher in pitch. The octave has been divided into twelve semitones, which comprise most of the tonal material generally used in Western music. The names given to the tones in the diatonic scales are the first seven letters of the alphabet: A, B, C, D, E, F, and G. All scales may be transposed, that is, they may begin on any tone within an octave.

Scales other than the diatonic that are used in Western music are: (1) the chromatic or dodecuple scale, which consists of all the twelve different semitones into which an octave is di-

vided; (2) the whole-tone scale, in which the interval (q.v.) between two notes of the scale consists of two semitones; (3) the pentatonic, or five-tone, scale; and (4) microtonal scales, that is, scales containing intervals of less than a semitone. The accompanying chart, in which 1 = whole tone; $\frac{1}{2}$ = half tone, gives the letter names and shows the size of intervals in most of the scales used in Western music. See MODE: TWELVE-TONE SYSTEM.

Diatonic Major Scale

$c \overset{1}{\curvearrowright} d \overset{1}{\curvearrowright} e \overset{\frac{1}{2}}{\curvearrowright} f \overset{1}{\curvearrowright} g \overset{1}{\curvearrowright} a \overset{1}{\curvearrowright} b \overset{\frac{1}{2}}{\curvearrowright} c'$

Diatonic Minor Scales pure

$c \overset{1}{\curvearrowright} d \overset{\frac{1}{2}}{\curvearrowright} e^b \overset{1}{\curvearrowright} f \overset{1}{\curvearrowright} g \overset{\frac{1}{2}}{\curvearrowright} a^b \overset{1}{\curvearrowright} b^b \overset{1}{\curvearrowright} c'$

harmonic

$c \overset{1}{\curvearrowright} d \overset{\frac{1}{2}}{\curvearrowright} e^b \overset{1}{\curvearrowright} f \overset{1}{\curvearrowright} g \overset{\frac{3}{2}}{\curvearrowright} a^b \overset{1\frac{1}{2}}{\curvearrowright} b^b \overset{\frac{1}{2}}{\curvearrowright} c'$

melodic (ascending)

$c \overset{1}{\curvearrowright} d \overset{\frac{1}{2}}{\curvearrowright} e^b \overset{1}{\curvearrowright} f \overset{1}{\curvearrowright} g \overset{1}{\curvearrowright} a \overset{1}{\curvearrowright} b \overset{\frac{1}{2}}{\curvearrowright} c'$

melodic (descending)

$c \overset{1}{\curvearrowright} d \overset{\frac{1}{2}}{\curvearrowright} e^b \overset{1}{\curvearrowright} f \overset{1}{\curvearrowright} g \overset{\frac{1}{2}}{\curvearrowright} a^b \overset{1}{\curvearrowright} b^b \overset{1}{\curvearrowright} c'$

Chromatic Scale

$c \overset{\frac{1}{2}}{\curvearrowright} c^\sharp \overset{\frac{1}{2}}{\curvearrowright} d \overset{\frac{1}{2}}{\curvearrowright} d^\sharp \overset{\frac{1}{2}}{\curvearrowright} e \overset{\frac{1}{2}}{\curvearrowright} e^\sharp \overset{\frac{1}{2}}{\curvearrowright} f \overset{\frac{1}{2}}{\curvearrowright} f^\sharp \overset{\frac{1}{2}}{\curvearrowright} g \overset{\frac{1}{2}}{\curvearrowright} g^\sharp \overset{\frac{1}{2}}{\curvearrowright} a \overset{\frac{1}{2}}{\curvearrowright} a^\sharp \overset{\frac{1}{2}}{\curvearrowright} b \overset{\frac{1}{2}}{\curvearrowright} c'$

Whole-Tone Scale

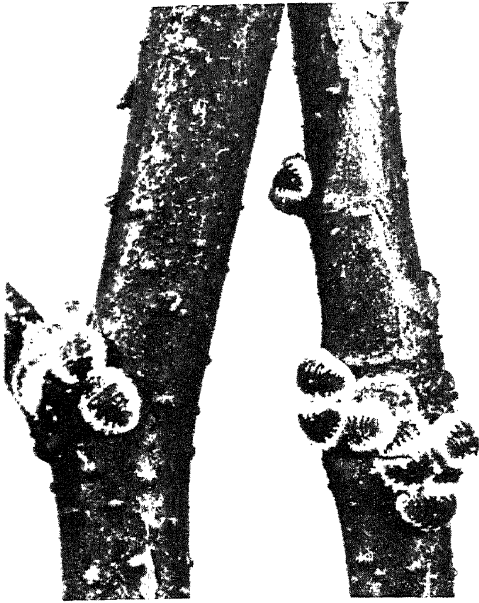
$c \overset{1}{\curvearrowright} d \overset{1}{\curvearrowright} e \overset{1}{\curvearrowright} f^\sharp \overset{1}{\curvearrowright} g^\sharp \overset{1}{\curvearrowright} a^\sharp \overset{1}{\curvearrowright} c'$

Pentatonic Scales

$c \overset{1}{\curvearrowright} d \overset{1\frac{1}{2}}{\curvearrowright} f \overset{1}{\curvearrowright} g \overset{1}{\curvearrowright} a \overset{1\frac{1}{2}}{\curvearrowright} c'$

$c \overset{1}{\curvearrowright} d \overset{1}{\curvearrowright} e \overset{1\frac{1}{2}}{\curvearrowright} g \overset{1}{\curvearrowright} a \overset{1\frac{1}{2}}{\curvearrowright} c'$

SCALE INSECT, or **SCALE LOUSE** or **BARK LOUSE**, common name applied to any of numerous homopterous bugs constituting the superfamily Coccoidea. The bugs are so called because the adult females attach themselves by their mouthparts to the stems of plants and secrete a waxy, powdery, or calcareous, scalelike substance for protection. Scale insects are almost world wide in distribution. They vary in size from that of a pinhead to a length of over 1 in. The young live by sucking plant juices. Males undergo a complete metamorphosis; the adult males have six well-developed legs and antennae and a single pair of wings, and are characterized by the complete absence of mouthparts.



Elm Scale, *Chionaspis americana*

Roche -
National Audubon Society

The females retain their piercing and sucking mouthparts throughout life; they are wingless and undergo degeneration of the legs and antennae. While attached to their hosts, female scale insects lay as many as 3,000,000,000 eggs in one season. Scale insects are among the most destructive of orchard and timber pests (see ENTOMOLOGY, ECONOMIC), injuring trees not only by sucking the sap but also by injecting poisonous substances with their mouthparts. Some species, however, are valued by man for their secretions; see COCHINEAL; LAC. About 500 species of scale insects are found in the United States.

Among the best-known American scale insects are the cottony-cushion or fluted scale, *Icerya purchasi*, so called because of the grooved, fluffy, white eggs it lays, and the San José scale, *Quadraspidiotus perniciosus*, so called because it was introduced to this country at San José, Calif. The cottony-cushion scale was introduced from Australia in 1868 and was very destructive until a ladybird beetle (q.v.), *Rodolia cardinalis*, was imported to hold it in check. The San José scale is a round insect that destroys apple, pear, and other fruit trees; it secretes about itself a hard, gray coating that is extremely resistant to sprays. The scales most commonly encountered by the home gardener are the soft scales of the genus *Lecanium*. The common soft or flat scale, *L. hesperidum*, parasitizes many house, garden, and greenhouse plants; the hemispherical scale, *L. hemisphericum*, is a common

greenhouse pest throughout the world. The terrapin scale, *L. nigrofasciatum*, so called because the shell it secretes resembles a terrapin's shell, infests maple, sycamore and poplar trees; see TERRAPIN, DIAMONDBACK. Other well-known soft scales are the peach scale, *L. persicae*, the apricot scale, *L. corni*, and the black scale, *L. oleae*, which attacks olives and oranges in California. The mussel scales constituting the genus *Lepidosaphes* have thick shells and are mussel shaped; a well-known species is the oystershell scale, *L. ulmi*, which attacks a variety of trees. Closely related to the mussel scales are the ground pearls constituting the genus *Margarodes*, found chiefly in South America and the West Indies; *M. formicarum* of the Bahamas is handpicked and strung into necklaces. Other important genera are *Pulvinaria*, including the cottony maple scale, *P. vitis*, and the woolly maple-leaf scale, *P. acericola*; and *Chionaspis*, including the pine-leaf scale, *C. pinifoliae*, and the scurfy apple scale, *C. furfura*. See also MEALY BUG.

Many scale insects can be controlled by coating trees with kerosene in the late winter when the naked young have hatched, or by spraying trees, covered with tents, with hydrocyanic acid which destroys many encysted scales. Experimental work is being done on practical application of the destruction of scale insects by chalcid flies (q.v.) and other insects.

SCALE, WEIGHING or BALANCE, mechanical device commonly used in the household and in scientific laboratories, business establishments, and industry to measure the weight of an object or a substance. For a discussion of the principles behind various types of scales, see WEIGHING. See also WEIGHTS AND MEASURES.

SCALIGER, name of two eminent classical scholars who were father and son.

Julius Caesar Scaliger (1484-1558), Italian physician and classical scholar, born in Riva. He discontinued a military career and began a medical practice at Agen, France, in 1525. His best-known works are *De Causis Linguae Latinae* ("origins of the Latin language", 1540), which was the first Latin grammar based on a scientific method, and *Poetice* ("Poetry", 1561), which established many of the principles of French classicism. He published two violent orations against the Dutch scholar Desiderius Erasmus (q.v.) because Erasmus had satirized the Cicero-nians, followers of the style of the ancient Roman orator Marcus Tullius Cicero (q.v.). Scaliger also wrote works on botany and zoology and advocated a new classification system for plants based upon their characteristic forms.

SCALLION

Joseph Justus Scaliger (1540–1609), French classical scholar, born in Agen. He acquired a mastery of Latin under the guidance of his father. Upon the latter's death in 1558, the young Scaliger went to the University of Paris, where he began the study of Greek and mastered the language in a very short time. He was professor of philosophy at the Genevan Academy (now the University of Geneva) from 1572 to 1574 and research professor at the University of Leiden in the Netherlands from 1593 until his death.

Scaliger laid the foundation for textual analysis of the classics by his editions of numerous Latin authors. In his *De Emendatione Temporum* ("On the Correction of Chronology", 1583) and *Thesaurus Temporum* ("Repertory of Dates", 1606), he set forth a scientific method of chronology that became the basis for the modern study of ancient history.

SCALLION. See SHALLOT.

SCALLOP, or FAN SHELL or PECTEN, common name applied to any of the marine, filibranchiate, bivalve mollusks constituting the family Pectinidae, found in deep and shallow water in most seas. About 200 species are known; see MOLLUSCA. Scallops bear ridged shells with the lower valve usually larger than the upper. The ridges radiate out from each valve in the shape of a fan. The edges of the shell are sharp and undulating, or scalloped, giving these animals their common name. The shell of the scallop is opened and closed by a single large muscle, the adductor muscle, which is the only portion of the scallop used as food in the United States. The mantle bears numerous, fluorescent, complex eyes along its border. Scallops rarely attach themselves to rocks; they swim actively about, or rest on the ocean bottom on the lower valve. The animals are hermaphroditic. Most scallops valued for food belong to the genus *Pecten*. *P.*

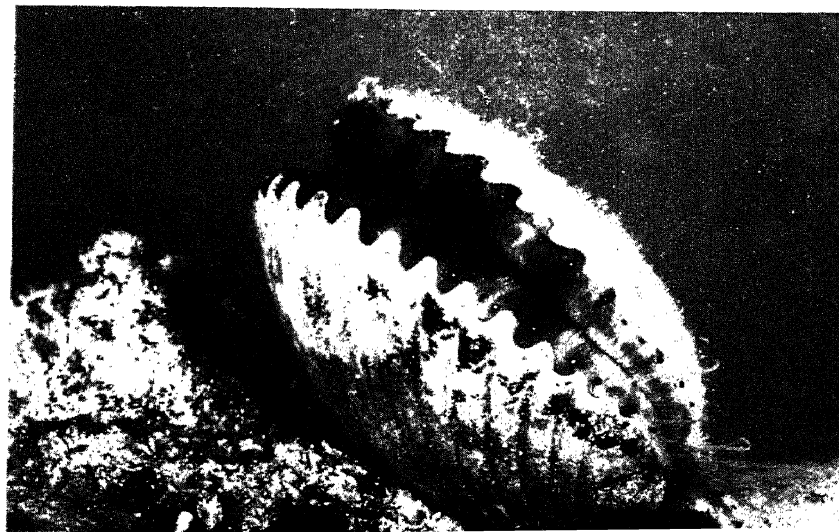
irradians is the common, edible scallop of the North Atlantic Ocean.

SCALPING, cutting and tearing the skin of the scalp from an enemy, either alive or dead. The severed scalp was believed to bestow upon the victor the power of the victim and frequently also served as a trophy. Scalping was practiced in Europe by the ancient Visigoths and Franks and in Asia by the Scythians. Among American Indians it was originally limited to a small area in the eastern United States and in the lower Saint Lawrence R. region of Canada. During the French and Indian War (q.v.), the French offered bounties for British scalps, and the British retaliated by offering bounties for the scalps of both Frenchmen and Indians. Many Indian tribes that are known not to have practiced scalping adopted the practice after it had been made remunerative. See AMERICAN INDIANS: *Indians of the United States and Canada: General Cultural Characteristics*.

SCALY ANTEATER. See PANGOLIN.

SCANDERBEG, or (Turk.) ISKENDER BEY, real name GEORGE CASTRIOTA (1403?–68), Albanian chief and national hero. The son of an Albanian prince, he was sent to Constantinople (now Istanbul, Turkey) as a hostage when the Ottoman Turks began to occupy Albania. He was educated as a Muslim and enlisted in the Turkish army. His military skill earned him favor with the sultan, and he was given a command. In 1443, when he learned that Albania had revolted against the Turks, Scanderbeg deserted and returned to his native land. He renounced Islam for Christianity and became the leader of the Albanian chiefs. In 1461 Scanderbeg, with the aid of Pope Pius II (see under Pius) and of the governments of Venice, Naples, and Hungary, forced the Turks to accept a ten-year armistice. When Scanderbeg abrogated the armistice,

Scallop, Pecten maximus
Robert Hermes -
National Audubon Society



since in 1463 he was forced to fight Turkey without the aid of his former allies, and shortly after his death, Albania was defeated.

SCANDINAVIA, name applied in a restricted geographical sense to the peninsula of Norway and Sweden (q.v.). In historical and cultural usage, the term "Scandinavia" includes Denmark and Iceland, and occasionally Finland (q.v.).

SCANDINAVIAN LANGUAGES AND LITERATURE. See DANISH LANGUAGE; DANISH LITERATURE; ICELANDIC LITERATURE; NORWEGIAN LANGUAGE; NORWEGIAN LITERATURE; SWEDISH LANGUAGE; SWEDISH LITERATURE.

SCANDINAVIAN MYTHOLOGY, pre-Christian religious beliefs of the Scandinavian people, called Norsemen (q.v.), a body of legends and myths about the origins of the universe, ancient heroes, and gods who are sometimes approximate counterparts of the deities in classical mythology; see GREEK RELIGION AND MYTHOLOGY. Because most information about Scandinavian mythology has been transmitted and altered by later, medieval Christian historians, it is difficult to assess accurately the religious beliefs, attitudes, and practices of the Norsemen. Clearly, however, Scandinavian mythology developed slowly and the relative importance of different gods and heroes varied at different times and places. Thus Odin (q.v.), chief of the gods, may have become important not long before the myths were recorded; minor gods, including Ull, Njord, a fertility god, and Heimdell, may represent older deities who had lost strength and popularity as Odin became more prominent. Although Odin, a god of war, is associated with learning and wisdom, he is represented as having acquired his wisdom from others. Most information about Scandinavian mythology is preserved in Norwegian literature (q.v.), in the two *Eddas* (see EDDA) and later sagas; other material appears in commentaries by the Danish historian Saxo Grammaticus (q.v.) and the German writer Adam of Bremen (fl. about 1075); see also ICELANDIC LITERATURE. Fragments of legends are sometimes preserved in old inscriptions and in later folklore.

Gods and Heroes. With Odin, major deities were his wife Frigga, goddess of the home; Thor (q.v.), who protected men and the other gods from the giants; Frey (q.v.), a god of prosperity; and Freyja, sister of Frey, a fertility goddess. Other, lesser gods were Balder (q.v.), Hermod, Tyr, Bragi, and Forseti; Idun, Nanna, and Sif were among the goddesses. Except as noted, most of these deities did not seem to have special functions in the Scandinavian religion; they

merely appear as characters in legendary tales. Many ancient mythological heroes, some of whom may have been derived from real persons, were believed to be descendants of the gods; among them were Sigurd the Dragon-slayer, Helgi Thrice-Born, Harald Wartooth, Hadding, Starkad, and the Valkyries. The Valkyries, a band of warrior-maidens that included Svava and Brynhild, or Sigdrifa, served Odin as choosers of slain warriors, who were taken to reside in Valhall, near the gods (see VALKYRIE); ordinary men were received after death by Hel in a cheerless world underground. Scandinavian mythology included dwarves; elves; and the Norns, who distributed fates to mortals. The Norsemen also had personal spirits, called *Fylgja* or *Hamingja*, symbols that represented a concept approaching the Christian idea of the soul. The principle of evil among the gods was represented by the trickster Loki, whose relationship to the divine hierarchy was one of great ambiguity; no records indicate that Loki was worshipped by the Norsemen. The usual collective designation for the gods was Aesir, but the gods as we know them were a confederation of two formerly warring divine tribes, the Aesir and the Vanir. Odin was originally the leader of the Aesir, which consisted of twelve gods, although various sources list a total of about seventeen different gods as members of the tribe. Together all the gods lived in a divine city, Asgard (q.v.), each in his own residence.

The Eddic poem "Völuspá" ("Prophecy of the Seeress") portrays a striking period of primeval chaos, followed by the creation of giants and gods and, finally, of mankind. Ginnungagap was the yawning void, Jotunheim the home of the giants, Niflheim the region of cold, and Muspelheim the realm of heat. The great world-tree, Yggdrasil, reached through all time and space, but it was perpetually under attack from Nidhogg, the evil serpent. The fountain of Mimir, source of hidden wisdom, lay under one of the roots of the tree.

Ceremonial Ritualism. The Scandinavian gods were served by a class of priest-chieftains called *gothar*. Worship was originally conducted outdoors, under guardian trees, near sacred wells, or within sacred arrangements of stones. Later, wooden temples were used, with altars and with carved representations of the gods. The most important temple was at Old Uppsala, Sweden, where animals and even human beings were sacrificed.

SCANDIUM, metallic element, one of the group of rare earths (q.v.), with at.no. 21, at.wt. 44.96, b.p. estimated over 2400° C. (4352° F.),

SCAPA FLOW

m.p. about 1540° C. (2804° F.), sp.gr. 3.02, and symbol Sc. It was discovered in 1879 by the Swedish chemist Lars Fredrik Nilson (1840–99), eight years after the Russian chemist Dmitri Ivanovich Mendeleev (q.v.) had predicted, on the basis of the periodic law (q.v.), that the element exists in nature and that its properties resemble those of the element boron. Scandium occurs in rare minerals such as wolframite. It is forty-third in order of abundance of the elements in the crust of the earth. It forms trivalent, colorless salts. Neither the metal nor its salts have any commercial application.

SCAPA FLOW, Great Britain, sea basin in Scotland, in the Orkney Islands. It is about 15 mi. long and 8 mi. wide and contains several islets. Scapa Flow was the principal naval base of the British during World War I and World War II. The German fleet that surrendered to the Allies in November, 1918, was interned at Scapa Flow. On June 21, 1919, one week before the Versailles Treaty (see VERSAILLES, TREATY OF) was signed, the German crew scuttled the German ships, preventing their subsequent use by the Allies. On Oct. 14, 1939, during World War II, a German U-boat penetrated the supposedly secure harbor of Scapa Flow and sank the battleship H.M.S. *Royal Oak*.

SCARAB, any of various large, bright-colored beetles (see BEETLE) of the family Scarabaeidae, of which more than 30,000 species are found worldwide. In addition to their brilliant coloring and bulky size, up to 6 in. in length, scarabs are distinctive for diverse horns or protuberances growing on the head or thorax; those on the males of many species are used in combat. Scarabs are divided into two groups, the scavenging dung beetles, which feed on decaying plants, and the chafers, which feed on young plants. All species, however, possess layered antennae as sense organs. The dung beetles lay their eggs in balls of dung, on which their young feed. Other species, such as the leaf-eating June beetles, or June bugs, of the genus *Phyllophaga*, also known as May beetles, deposit white "c"-shaped larvae in the soil. More than 900 species of scarabs are found in North America; one of the best-known species is the Japanese beetle (q.v.).

In Egypt, an important species of scarab, the tumblebug, *Scarabaeus sacer*, was held sacred by the ancient, sun-worshiping Egyptians, who regarded them as symbolizing immortality. Amulets, seals, and rings in the shape of the beetle came to be known as scarabs.

SCARBOROUGH, Great Britain, municipal borough and port of North Riding, Yorkshire,

England, on the North Sea, 37 miles N.E. of York. Scarborough is a popular health resort. It is the site of a church and a castle, both built in the 12th century. Pop. (1971) 11,536.

SCARLATINA. See SCARLET FEVER.

SCARLATTI, name of an Italian family of composers and musicians including the following who were father and son.

Alessandro Scarlatti (1659–1725), composer, born in Palermo, Sicily, and probably trained in Rome under the Italian oratorio composer Giacomo Carissimi (q.v.). His earliest known opera *L'Errore Innocente*, was produced in Rome in 1679. In 1684 a more important work, *Pompeii*, was performed in Naples, and Scarlatti was appointed musical director at the Neapolitan court. In 1702–03 he lived in Florence under the patronage of Ferdinand de Medici (1663–1713), heir to the Grand Duchy of Tuscany and a member of the powerful Medici (q.v.) family. Lacking a permanent post, Scarlatti accepted the position of assistant choirmaster at the Church of Santa Maria Maggiore in Rome in 1703. He reestablished himself in Naples in 1713, when he became the musical director of the Austrian viceroy, and director of the Conservatory di Sant' Onofrio. After 1719 his popularity in Naples waned; he went to Rome, where he remained until 1723. He then returned to Naples for the last time, and lived there until his death.

Scarlatti was one of the first opera composers to differentiate the singing styles of aria and recitative (qq.v.). His opera overtures estab-

Alessandro Scarlatti

Bettmann Archive



ned the Neapolitan-overture type in which there are three movements in fast, slow, and fast tempos, respectively. His cantatas, numbering more than 600, introduced many advanced harmonic procedures to the musical vocabulary of the time.

Domenico Scarlatti (1685–1757), harpsichordist and composer, born in Naples. He studied first with his father and later with the Italian composer Francesco Gasparini (1668–1727). Scarlatti first attracted attention by his revision (1704) of the opera *Irene* by the Italian composer Carlo Francesco Pollaro (1653–1722). In subsequent years Scarlatti lived in Rome, Naples, and Lisbon, and frequently toured Europe as a traveling virtuoso. In 1729 he was summoned to the Spanish court at Madrid, which remained his residence for the rest of his life. Scarlatti was the founder of the modern school of keyboard technique; he was the first composer to call for such devices in performance as arpeggios, the rapid repetition of a single note, and the crossing of hands. His keyboard compositions, entitled *Sonatas* (q.v.), are all short pieces; about 550 have been preserved. In addition to keyboard music, Scarlatti composed several operas, a quantity of religious music, and other works scored for various instruments.

SCARLET FEVER or **SCARLATINA**, acute, febrile, infectious and contagious disease, caused by Group A of the bacteria *Streptococcus hemolyticus*. Actually scarlet fever is only a different clinical variant of the same streptococci which cause strep throats. Scarlet fever is characterized by a granular or papillar rash over the entire body except, usually, the face. Usually patients also have the severe throat infection which characterizes streptococcal pharyngitis and tonsillitis. The causative organism usually enters the body through the nose or mouth, being transmitted from person to person by direct contact, by sprays of droplets from the respiratory tract of an infected person, or by indirect contact through the use of utensils previously handled by an infected person. Scarlet fever used to be also occasionally transmitted by nonpasteurized milk obtained from cows having streptococcal infection of the udders, but today this is very rare. The disease most commonly affects children between the ages of two and ten. The severity of the disease tends to decrease with increasing age. The disease usually occurs in temperate regions during the winter months. The incubation period of scarlet fever as with other strep infections is usually 3 to 5 days but may range from 1 to 10.

The typical initial symptoms of the disease are

headache, sore throat, chills, fever, and general malaise. The tongue becomes heavily coated. The causative organism usually localizes in the pharynx, which becomes red and swollen. From two to three days after the first appearance of symptoms, red spots may appear on the palate; the coating leaves the tongue, and bright-red papilla emerge giving it an appearance commonly called strawberry tongue. Meanwhile on the skin a characteristic eruption appears on the chest and usually spreads over the entire body except the face. The rash fades on pressure. It reaches its peak intensity usually on the second day and then begins to fade. The fever, which is often as high as 104° F. or 105° F., generally lasts only a few days but may last a week or more. In about a week the rash has usually faded and the skin begins to peel. The peeling lasts for about 2 to 4 weeks.

Scarlet fever may be complicated by an infection of the middle ear mastoids or sinuses, or even pneumonia. Occasionally, inflammation of the kidneys (glomerular nephritis) may develop after scarlet fever. It is probably due to an immunological reaction in the kidneys to streptococcal antigens produced in the acute infection. Since the introduction of penicillin, most cases of scarlet fever can be cured without permanent aftereffects.

Most persons develop a permanent immunity after one attack of scarlet fever. The Dick test for scarlet fever was once widely used to determine susceptibility to the disease; see DICK, GEORGE FREDERICK. Today, with the early use of antibiotics in treatment of streptococcal infections, scarlet fever has become quite rare, and Dick testing is no longer routine.

Compare GERMAN MEASLES; MEASLES.

L.J.V.

SCARLET LETTER, THE, famous psychological novel by the American writer Nathaniel Hawthorne (q.v.), published in 1850. The novel, set in 17th-century Puritan Boston, concerns the concepts of good and evil and the consequences of adultery. The main character, Hester Prynne, is sentenced to wear a scarlet "A", meaning adulteress. The plot revolves around Hester, the minister, Arthur Dimmesdale, her secret lover; and her husband, in the disguise of a physician, Roger Chillingworth. See also AMERICAN LITERATURE: *Early 19th Century*.

SCARRON, Paul (1610–60), French writer, born in Paris. He took minor orders and became an abbé. A nervous disease made him an invalid from the age of twenty-seven until his death. He married Françoise d'Aubigné (see MAINTENON, FRANÇOISE D'AUBIGNÉ, MARQUISE DE), who, after Scarron's death, became the second consort of

SCARSDALE

the French king Louis XIV (q.v.). Scarron's most famous work is a picaresque novel, *Le Roman Comique* (1651–57; Eng. trans., *The Comical Romance*, 1741). He also wrote short stories, plays, satires, including a parody of the *Aeneid* (q.v.), and burlesque poems. Scarron's writings directly influenced the French dramatist Molière (q.v.).

SCARSDALE, village of New York, in Westchester Co., about 4 miles s. of White Plains. Scarsdale manufactures machinery and wood products. The site of many skirmishes in the American Revolution, Scarsdale has many historic buildings dating from that period. The village was settled about 1701 and incorporated in 1915. Pop. (1960) 17,968; (1970) 19,229.

SCENT GLANDS, specialized organs that produce secretions having odors with specific functions in animal behavior. Anal glands are common in carnivores and serve in sexual attraction and defense; for example, the spray of a skunk effectively repels most predators. Many members of the dog family, the Canidae, mark stones and other objects with a mixture of urine and glandular secretions, indicating their territoriality (q.v.), or domain. Glands of other animals, such as dorsal and ventral skin glands of various rodents, facial glands of antelope and deer, and glands between the toes of some deer, also serve to mark territories or trails. Musk from civets, muskrat, and beaver has been used in the perfume trade. See ANIMAL ATTRACTANTS; ANIMALS, CHEMICAL SENSE IN.

S.A.

SCHACHT, Hjalmar Horace Greeley (1877–1970), German economist, financier, and National Socialist official, born in Tinglev (now Tinglev, Denmark). A brilliant student at Kiel University, he was director of two large German banks before World War I. After the war, he was appointed (1923) special currency commissioner with the task of combatting inflation. He helped to stabilize the mark and the following year was appointed president of the Reichsbank, Germany's central bank, serving in that capacity until 1930. From the time he left the middle-of-the-road Democratic Party in 1926, Schacht turned increasingly conservative and nationalistic in his political and financial views, resisting foreign influence and German reparations (q.v.). During the 1930's he had an important role in building the alliance between the National Socialist Party and big business organizations. As president of the Reichsbank again from 1933 to 1939 and minister of economics from 1934 to 1937, he effected a controlled economy and barter agreements with foreign countries, vital to German rearmament. He

gradually began to oppose German militarism and shortly before the outbreak of World War II he resigned most of his national posts, but remained a government minister until 1942. In 1944 he was imprisoned as a suspect in a plot against the life of the German dictator Adolf Hitler (q.v.). After the war he was acquitted as a war criminal by the military tribunal at Nuremberg (see WAR-CRIMES TRIALS: *Nuremberg Trials*); but he was later convicted and briefly imprisoned by a postwar German court for having supported Hitler's war efforts. He was released from prison in 1949 and returned to banking, becoming a financial advisor to countries of the Far and Middle East.

SCHAEERBEEK, city of Belgium, in Brabant Province, industrial suburb of Brussels, N.E. of the city proper. A rail junction, it has extensive railroad yards and an electric-power station. It is also called Schaarbeek. Pop. (1971 est.) 118,947.

SCHECHTER, Solomon (1850–1915), Rumanian-American Jewish scholar and founder of Conservative Judaism, born in Focșani, Rumania, and educated in Vienna and Berlin. In 1882 he moved to England and from 1890 to 1901 was a lecturer on the Talmud (q.v.) at the University of Cambridge. While at Cambridge he gained wide recognition as a scholar when he identified a fragment of Hebrew text brought from Egypt as part of the missing Hebrew original of Ecclesiasticus (q.v.). He then traveled to Cairo for the university and collected thousands of manuscripts in the old synagogue there. Schechter came to the United States in 1901, and from that year until his death was president of the Jewish Theological Seminary, New York City. He was a founder of the United Synagogue of America, which was established to foster the principles of Conservative Judaism. He edited the *Jewish Quarterly Review* (1889–1908) and the *Jewish Encyclopedia* (1904, 2 vol.); his writings include *Studies in Judaism* (1908). See JUDAISM: *Modern Judaism*.

SCHEELE, Karl Wilhelm (1742–86), Swedish chemist, born in Stralsund, now in East Germany, at that time the capital of Swedish Pomerania. He had no formal training in chemistry, and studied the elements of science while apprenticed to an apothecary. In 1770 he came under the guidance of the Swedish chemist Torbern Olof Bergman (1734–84). Scheele became the proprietor of a pharmacy in Köping, Sweden, in 1775, and continued his chemical research, discovering and studying a great number of elements, compounds, and chemical reactions. He is credited with the discovery of the elements chlorine, barium, molybdenum, tung-

gen, nitrogen, and manganese; and he prepared oxygen from various oxides independently of and somewhat prior to the British chemist Joseph Priestley (q.v.), who is credited with the discovery of the element. He was the first to prepare many compounds, including tartaric acid, arsine, and hydrogen sulfide. He demonstrated that lactic acid was the acid component of sour milk. He also determined the properties and composition of hydrogen cyanide and those of citric, malic, oxalic, prussic, and gallic acids. In 1931 the *Collected Papers of Karl Wilhelm Scheele* were published.

SCHEELITE, mineral composed of calcium tungstate, CaWO_4 , named after the Swedish chemist Karl Wilhelm Scheele (q.v.). It crystallizes (see CRYSTAL) in the tetragonal system in well-defined crystals or in massive, granular formations. The mineral is white, yellow, green, or brown; it is translucent and the luster is vitreous to adamantine. Most specimens are fluorescent. The hardness (q.v.) ranges from $4\frac{1}{2}$ to 5 and the specific gravity ranges from 5.9 to 6.1. In Europe the mineral occurs in Czechoslovakia, East Germany, and Cornwall, Great Britain. It is found in the United States in Nevada, California, Arizona, Utah, and Colorado. Scheelite is used as an ore of wolfram (q.v.), or tungsten.

SCHEER, Reinhard (1863–1928), German naval commander, born in Obernkirchen, Hesse-Nassau. Successive promotions in the German navy made him, in 1909, a rear admiral and, a year later, chief of staff of the German High Seas Fleet. In 1916 he was appointed the commander of the fleet. During World War I, he avoided direct battle with the large British navy, utilizing tactics of submarine warfare against merchant shipping as the primary German strategy. In the Battle of Jutland Scheer commanded the German High Seas Fleet against the British Grand Fleet in a memorable encounter, the only major engagement of the two fleets during the war; see JUTLAND, BATTLE OF. Both Great Britain and Germany claimed victory, with the British losing more ships and the Germans a greater proportion of their navy. Great Britain, however, gained control of the seas as a result of the battle. Scheer became chief of the admiralty staff and retired after the war. He wrote several books, including *Vom Segelschiff zum U-Boat* (*From Sailing Ship to Submarine*, 1926).

SCHEHERAZADE. See ARABIAN NIGHTS.

SCHELDT or **SCHELDE**, river of Europe, rising in N. France, in Aisne Department. It flows N. past the cities of Cambrai and Valenciennes, and, entering Belgium, passes Tournai, Oudenaarde, Ghent, Dendermonde, and Antwerp,

having received among other tributaries the Lys and the Dender rivers. Opposite the island of South Beveland, the Netherlands, it divides into two arms. The left or southern, called the Western Scheldt, flows s. of the islands of South Beveland and Walcheren and empties into the North Sea at the city of Flushing; the right or northern arm, called the Eastern Scheldt, passes to the N. of South Beveland and North Beveland. The river is navigable for most of its 270-mi. length.

SCHELLING, Friedrich Wilhelm Joseph von (1775–1854), German philosopher, born in Leonberg, Württemberg, and educated at the University of Tübingen. He served on the faculty of most of the leading universities in Germany and in 1841 was called to Berlin by Frederick William IV (q.v.), King of Prussia. The philosophy of Schelling underwent a continuing evolution. His original philosophy was based chiefly upon a close study of the views of the German philosophers Immanuel Kant and Johann Gottlieb Fichte and the Dutch philosopher Baruch Spinoza (qq.v.). The distinguishing principle of this phase of his philosophy is the identity of subject and object, the basis of an identity philosophy, or a system of identity, pantheistic in its general nature, equating God with the forces and laws of the universe. In the second period, rejecting pantheism (q.v.) as negative, he developed his positive philosophy. In his positive philosophy Schelling defines human existence as the mode of self-consciousness on the part of the Absolute. The unity of man with the Absolute is seen as necessary to a process in which the emergence of God as personality is effected by the personal character of human consciousness.

Schelling wrote many works including *Über das Verhältniss der bildenden Künste zu der Natur* (1807; Eng. trans., *The Philosophy of Art*, 1845), *Philosophische Untersuchungen über das Wesen der menschlichen Freiheit* (1809; Eng. trans., *Of Human Freedom*, 1936), and fragments of a large projected but unpublished work *Die Weltalter*, which were translated into English as *The Ages of the World* (1942).

SCHENECTADY, city in New York, and county seat of Schenectady Co., on the Mohawk R., about 16 miles N.W. of Albany. The city is an important manufacturing center and the headquarters of the General Electric Company. Industries include electrical, atomic, and jet machinery and materials; diesel locomotives; electricity-insulating materials; plates and printing; concrete products; plastics; synthetic resins and varnishes; knitwear; and meat, dairy, and

SCHERZO

baked products. Schenectady is the site of Union College and University (q.v.), established in 1795. Places of interest include pre-Revolutionary buildings, among them Saint George's Episcopal Church. The Schenectady Museum has collections on fine arts and natural history.

History. A settlement was established by the Dutch on the site of the city in 1661 and quickly became prosperous. In 1690 it was attacked by a force of French and Indians, who burned the village, killed sixty of the settlers, and took thirty captives to Canada. Schenectady was rebuilt and was incorporated in 1798. After the American Revolution it became an important river port and in the 1830's it developed as a railroad center. Pop. (1960) 81,682; (1970) 77,859.

SCHERZO (It., "joke" or "play"), in music, rapid, vigorous instrumental composition or movement, normally written in triple time, that is, with three beats to each measure; see MUSICAL NOTATION. Because of the fast tempo of a scherzo, the three beats are compressed into a single rhythmic unit, and each measure is given one count. A scherzo is usually the second or third movement of an extended work, such as a sonata, symphony, suite (qq.v.), or string quartet. Historically, the term dates from the early 17th century. In 1607 the Italian composer Claudio Monteverdi (q.v.) wrote a collection of light, popular choral pieces entitled *Scherzi Musicali* ("musical jokes"); and in 1616 another Italian composer, Antonio Cifra (1584-1629), produced a set of *Scherzi Sacri* ("sacred scherzos"). In the instrumental music of the 17th century the term "scherzo" was used as a title for light pieces of irregular form; and in the sonatas of the 18th century the German composer Karl Philipp Emanuel Bach (see *under* BACH), the direction *allegretto scherzando* (It., "quickly and jokingly") is applied to playful, light movements. The Austrian composer Josef Haydn (q.v.) was the first to use the term for the middle movement of a piano sonata; later he again used the word as a title for movements in a set of string quartets known as *Gli Scherzi* ("the scherzos", 1781). The modern scherzo was given its character by the German composer Ludwig van Beethoven (q.v.). Beethoven developed the form as a substitute for the minuet (q.v.) movement that, until about 1800, was the customary middle movement of a large orchestral work. Haydn had already altered the stately character of the minuet, often making of it a brusque and rude peasant dance. The term "minuet" persisted, however, until the time of Beethoven.

Wide Emotional Range. Modern scherzos vary greatly. Some of Beethoven's scherzos are

frankly humorous; others, such as the scherzo of the Fifth Symphony (1809), are somber and reflective. The Austrian composer Franz Peter Schubert (q.v.) most closely follows Beethoven as a great master of the scherzo. The scherzos of the German composers Felix Mendelssohn (see *under* MENDELSSOHN) evoke a romantic fairyland, filled with elves and sprites; and Johannes Brahms (q.v.), in the scherzo of his Fourth Symphony (1884-85), wrote what is commonly considered the finest example of the form composed in the second half of the 19th century. The scherzos in the symphonies of the Austrian composer Anton Bruckner (q.v.) have a heavy, massive, peasant humor. Some 19th century composers used the scherzo as a vehicle for introducing into larger works distinctive national material, such as folk dances; typical examples are the scherzos in the symphonies of the Russian composer Pëtr Ilich Tchaikovsky and the Czechoslovakian composer Anton Dvořák (qq.v.). The four scherzo compositions for the piano by Frédéric Chopin (q.v.), of Poland, occupy a prominent place in the evolution of the scherzo as an independent form; with the exception of the light and sunny Fourth Scherzo, they are highly dramatic, gloomy, and somewhat macabre. Other French composers wrote important scherzos, such as the *Danse Macabre* ("Dance of Death", 1874) by Camille Saint-Saëns, *L'Apprenti Sorcier* ("The Sorcerer's Apprentice", 1897) by Paul Dukas; the *Scherzo Fantastique* (1907-08) by the Russian composer Igor Stravinsky (qq.v.) is another independent composition in this form. No important innovations in scherzo composition have been made in the 20th century.

SCHEVENINGEN, city and port of the Netherlands, in South Holland Province, part of The Hague, on the North Sea, 2 miles n.w. of the city center, with which it is connected by several canals. An important herring port, the city cans fish and manufactures fishing equipment, ice, and furniture. It has been a leading beach resort since 1818 and has extensive beaches and dunes, a marine radio station (1904), a lighthouse, and, in the Scheveningen Woods, a miniature children's village known as the Madurodam. Pop. (last separate count, 1960) 80,015. **SCHIAPARELLI, Giovanni Virginio** (1835-1910), Italian astronomer, born in Savigliano, and educated at Turin University. He was director of the astronomy observatory at Milan from 1862 until 1900, when he retired. He was the first to observe the asteroid Hesperia, in 1861, and to identify the orbits of various comets and shooting stars. He also made extensive studies of the

planets Mercury, Venus, and Mars (q.v.), and observed the markings on Mars, which he called canals. His writings include *Le Stelle Cadenti* ("Shooting Stars", 1873), and *L'Astronomia nell'Antico Testamento* ("Astronomy in the Old Testament", 1903).

SCHICK, Béla (1877–1967), Hungarian-American pediatrician, born in Boglár (now Balatonboglár), Hungary, and educated at Karl Franz University in Graz, Austria. He practiced medicine in Vienna beginning in 1902, and in the same year joined the medical faculty of the University of Vienna, serving as professor of pediatrics from 1918 to 1923. In the latter year he emigrated to the United States and served as chief pediatrician of Mt. Sinai Hospital in New York City from 1923 to 1942 and as professor of diseases of children at Columbia University from 1936 to 1942. Schick is best known for his development in 1913 of the Schick test for determining immunity or susceptibility to diphtheria (q.v.). In administering the Schick test a weak solution of diphtheria toxin is injected into the skin; if a red spot develops at the point of injection the subject is susceptible to diphtheria, whereas lack of reddening indicates immunity to the disease. Schick also made important studies of scarlet fever, tuberculosis, the nutritional needs of newborn children, and the effects of concentrated feeding during childhood.

SCHIEDAM, city of the Netherlands, in South Holland Province, on the Lower Rhine R., 3 miles w. of Rotterdam. It is noted for the distillation of gin that is exported throughout the world. It also has shipyards, and factories that manufacture chemicals and glass. Pop. (1972 est.) 82,967.

SCHILLER, Johann Christoph Friedrich von (1759–1805), German poet, dramatist, philosopher, and historian, born in Marbach, Württemberg, and educated at the military school of the duke of Württemberg. Schiller studied law and then medicine; in 1780 he was appointed physician to a military regiment stationed in Stuttgart. As a student Schiller wrote poetry and finished his first play, *Die Räuber* ("The Robbers", 1781), which was successfully presented in 1782 at the National Theater in Mannheim. Arrested by the duke for leaving Württemberg without permission in order to witness the production, Schiller was forbidden to publish further dramatic works, and in September, 1782, he escaped from Württemberg.

Early Dramas. During the next ten years he lived and wrote, often under assumed names to avoid discovery and possible extradition to Württemberg, in various parts of Germany, in-



Johann von Schiller

Photo Viollet

cluding Mannheim, Leipzig, Dresden, and Weimar. Schiller completed the tragedy *Kabale und Liebe* ("Intrigue and Love", 1783) and began work on the drama *Don Carlos* (1787; Eng. trans., 1795) in 1783 at Mannheim, where for the next year he was official dramatist for the Mannheim theater. His plays, which stressed personal liberty and morality, had great dramatic power. The idealistic *Don Carlos*, the first of his plays to be written in blank verse, which also deals with the struggle against official oppression, marks a transition to a more classical style of writing.

Influence of Goethe. During the following years Schiller devoted himself chiefly to historical and philosophical works. On the strength of his *Geschichte des Abfalls der Vereinigten Niederlande von der Spanischen Regierung* ("The Defection of the Netherlands", 1788) and through the recommendation of the German poet Johann Wolfgang von Goethe (q.v.), Schiller was appointed professor of history at the University of Jena in 1790. Schiller and Goethe first met in Jena two years later and subsequently formed a close friendship that proved intellectually stimulating to both men, then regarded as the two leading figures in contemporary German literature; see GERMAN LITERATURE: *The Classical Period*.

Through Goethe's influence Schiller turned from philosophical writing back to the writing

SCHIPPERKE

of poetry and plays, and his last years proved to be the most productive of his life. In 1799 he completed his masterpiece, *Wallenstein*, a three-part work in verse that includes a narrative prologue, *Wallensteins Lager* ("Wallenstein's Camp"), and the two full-length dramas *Die Piccolomini* (Eng. trans., *The Piccolomini*, 1800) and *Wallensteins Tod* (Eng. trans., *The Death of Wallenstein*, 1800). Based on events of the Thirty Years' War (q.v.), this work is considered one of the greatest historical dramas in world literature.

Weimar Period. Late in 1799 Schiller settled permanently in Weimar, where he subsequently completed the verse dramas *Maria Stuart* (1800; Eng. trans., 1800), *Die Jungfrau von Orleans* ("The Maid of Orleans", 1801), *Die Braut von Messina* ("The Bride from Messina", 1803), and *Wilhelm Tell* (1804). At the time of his death he was at work on the tragedy *Demetrius*.

Other Works. Schiller is regarded as the greatest dramatist in the history of the German theater and one of the greatest of all European dramatists (see *DRAMA: German Drama*). His plays are characterized by moral idealism, strong optimism, eloquent poetic diction, a classic sense of form, and powerful intellectual and emotional appeal. Schiller also translated foreign plays into German, including *Macbeth* by the English dramatist William Shakespeare and *Phèdre* by the French dramatic poet Jean Baptiste Racine (qq.v.). His historical works include the *Geschichte des Dreissigjährigen Krieges* ("History of the Thirty Years' War", 1791–93). Among his philosophical works are the *Briefe über die Ästhetische Erziehung des Menschen* ("Letters on the Aesthetic Education of Man", 1795) and *Über Naive und Sentimentalische Dichtung* ("On Naive and Sentimental Poetry", 1795–96). His poetic works include the philosophical lyric "*Das Ideal und das Leben*" ("Ideal and Life", 1796); the famous "*Das Lied von der Glocke*" ("The Song of the Bell", 1800); and the hymn "*An die Freude*" ("Ode to Joy, 1785), which was set to music by the German composer Ludwig van Beethoven (q.v.) in the choral finale of his Ninth Symphony.

English translations of Schiller's complete works appeared in 1846–49.

SCHIPPERKE (Flemish, "little captain"), small dog derived several centuries ago in the Flemish provinces of the Netherlands (now comprising Belgium), from a black sheep dog known as the Leuvenaar. The schipperke was known as the spits or spitske until 1888, when it was given its present name in compliment to the proprietor of a Belgian canal-boat line who was instrumen-

tal in promoting interest in the breed; he used these dogs as watchdogs on his boats. The breed was imported into the United States about the same time and since about 1929 has become fairly popular in this country. It functions chiefly as a watchdog and pet; sometimes it is employed in hunting small game such as moles and rabbits. The schipperke weighs up to 18 lb., has a foxlike head; a small black nose; somewhat oval-shaped eyes, dark brown in color; and unusually intelligent and alert in expression; angular ears; a short, thick-set body; straight forelegs; and muscular hindquarters. The coat, solid black in color, is abundant and somewhat rough, and forms a heavy ruff about the neck.

SCHIRRA, Walter M(arty), Jr. (1923–) American astronaut, born in Hackensack, N.J. He attended Newark College of Engineering from 1940 until 1942, when he withdrew to attend the United States Naval Academy at Annapolis, Md. After graduating from Annapolis in 1945, Schirra took flight training at the Pensacola Naval Air Station. His combat experience was limited to the Korean War, in which he flew missions and was decorated three times. In 1959, while serving as a Navy test pilot, he was selected by the National Aeronautics and Space Administration (NASA) for training as an astronaut (q.v.). In October, 1962, Schirra made his first flight in space, in the Mercury Project one-man capsule, Sigma VII, which made six orbits of the earth; in December, 1965, he commanded the Gemini VI capsule in a mission which in-

Walter Schirra waits while his space suit is adjusted before a launching at Cape Kennedy, Fla. Wide World



planned rendezvous and docking maneuvers. In October, 1968, Schirra made his third space voyage, in the three-man Apollo VII craft, accompanied by two other astronauts, Air Force Lieutenant Colonel Donn F. Eisele (1930–) and Annie Walter Cunningham (1932–), a civilian. The three completed 163 orbits of the earth in eleven days. In 1969 he retired from NASA to join private industry; in 1973 he was elected chairman of Sernco, Inc., an engineering services company in Los Angeles, Calif. *See also* ASTRONAUTICS.

SCHISM, WESTERN or **SCHISM, GREAT**, dissolution of communion in the Western Christian Church (*see* ROMAN CATHOLIC CHURCH) that arose out of a disputed claim to the succession to the papal throne (*see* POPE). It existed from 1378 to 1417. On the death of Pope Gregory XI (1330?–78), Bartolomeo Prignano, a Neapolitan, was chosen pope by the majority of the cardinals in a conclave in Rome; he took the name Urban VI (*see under* URBAN). Soon afterward, however, a number of these cardinals withdrew and revoked the election. They declared it a forced election, caused by the violence in Rome, which had, according to them, overawed the conclave. In consequence they chose another pope, who took the name Clement VII (*see under* CLEMENT). The latter fixed his seat in Avignon (q.v.), France, and Urban VI remained in Rome. Each party had its adherents, and in each a rival succession was maintained until the convocation of the Council of Pisa in 1409. In this assembly both popes, the Roman pope Gregory XII (1327?–1417) and the Avignon pope (or Antipope) Benedict XIII (*see under* BENEDICT), were deposed, and a third, Alexander V (1340?–1410), was elected to be the sole pope. Benedict refused to comply, however, so the schism formally ended only in 1417, with the election of Martin V (*see under* MARTIN) by the Council of Constance; *see* CONSTANCE, COUNCIL OF. At this time Antipope John XXIII (*see under* JOHN), who had succeeded Alexander V, was deposed; Gregory XII resigned; and the claims of Benedict XIII were dismissed.

SCHIST, term applied to any of several metamorphic rocks in which the crystals of the predominating mineral are aligned in parallel layers, forming a large number of close, well-developed foliations. Schistose rocks are easily broken along a lamination, or schistosity, into thin, flaky plates. The various schistose rocks are named and characterized according to the predominating mineral which produces the foliation. Among the important schists are mica schist, hornblende schist, chlorite schist, and

talc schist. Quartz is usually the most predominant secondary mineral. The commonest schistose rock and, second to gneisses (*see* GNEISS), the commonest metamorphic rock is mica schist. Mica schist is composed of mica (q.v.), usually in the form of biotite or muscovite, and smaller amounts of quartz. Schists which contain important accessory minerals are characterized by the accessory mineral. Garnet-mica schist is a mica schist containing crystals of garnet (q.v.). *See also* GEOLOGY: *Petrology*.

SCHISTOSOMIASIS, or **BILHARZIASIS**, or **SNAIL FEVER**, disease caused by the infestation of the human body by flukes (q.v.), commonly called blood flukes, of the genus *Schistosoma*, belonging to the family Schistosomatidae. In many tropical and subtropical countries these flukes cause serious diseases; although rarely producing disease in temperate countries, they are widespread in the Temperate Zone. It is estimated that 150 to 200 million persons throughout the world are afflicted with diseases caused by blood flukes. Blood flukes spend most of their life cycle in two hosts; the adult stage is spent in a mammal, such as man, and the immature stages are spent in certain snails. Eggs discharged from man, the definitive host, hatch into larval forms in fresh water from which the larvae, miracidium, invade the snail (only specific snails will do), that acts as an intermediate host. The larval form of the parasite undergoes partial maturation in the snail, then escapes back into the water, as mature larvae called cercariae. They penetrate the skin of man from the water and then migrate through the blood vessels to specific capillaries as maturation completes. There they remain and lay eggs.

Blood Flukes in Man. Three species produce serious diseases. These are *S. hematobium*, *S. mansoni*, and *S. japonicum*, found in the tropics and in the Orient. About eight other species are known to produce irritations of the skin, commonly called swimmer's itch, of bathers in the lakes of the north-central United States, especially Michigan and Wisconsin, and of Canada, especially Manitoba. Only the species of blood flukes producing serious disease are described in this article.

The Egyptian blood fluke, *S. hematobium*, is distinguished from the other blood flukes by its yellow eggs, that are characterized by a spine on one end. Calcified eggs of the Egyptian blood fluke have been found in the urinary tracts of mummies in the tombs of Egypt. This worm was first described by the German physician Theodor Bilharz (1825–62) in 1851. The adult male Egyptian blood fluke is about $\frac{3}{8}$ in. long. The

SCHIZOMYCETES

body of the male has two lateral flaps of tissue that almost meet on the ventral surface of the body, forming a canal for the reception of the female during mating. The adult female is about $\frac{1}{2}$ in. long and is much thinner than the male. The cercariae of the Egyptian blood fluke pierce the skin or mucous membranes when a human bathes in infested water. Piercing the tissues, the cercariae make their way through the blood stream. In six to ten weeks they mature and become adult flukes. Eventually the flukes reach the venules and capillaries of the bladder. The flukes mate and deposit their eggs that, acting as foreign proteins, give rise to a severe inflammatory reaction in the walls of the bladder. The eggs dissolve the tissues of the bladder wall and find their way to the interior of the bladder; during their course through the bladder wall, hemorrhages are produced, causing bloody urine and pain during urination. Eggs can be found in the urine on microscopic examination.

The rectal blood fluke, *S. mansoni*, and the Japanese blood fluke, *S. japonicum*, concentrate in the blood vessels of the large intestine and liver. Eggs are discharged in the stools but some are carried up the portal veins to the liver where they cause inflammation and scarring, eventually causing cirrhosis, with enlargement of liver and spleen and, because of obstruction to blood flow through the liver, enlargement of veins, particularly in the esophagus (esophageal varices), that are prone to rupture, causing serious hemorrhage. The fluke, *S. mansoni*, is of particular importance in Puerto Rico.

Effects and Treatment. Untreated schistosomiasis may result in death. Various agents, such as fuadin and tartar emetic, have been used in the treatment of the disease.

None of the available drugs, however, is both completely effective and safe, and until such a drug is found, the best attack on schistosomiasis is preventive, including proper disposal of human wastes and extermination of snails in endemic areas. Recent development of blood tests has made the diagnosis of schistosomiasis much easier.

L.J.V.

SCHIZOMYCETES. See BACTERIA.

SCHIZOPHRENIA. See MENTAL DISORDERS: *Psychoses: Schizophrenia*.

SCHLEGEL, name of two German writers who were brothers.

August Wilhelm von Schlegel (1767–1845), critic, translator, and editor, born in Hannover, and educated at the University of Göttingen. He was the leading critic of the Romantic school of German literature, and with his brother Friedrich, who was the principal philosopher of the



August Wilhelm von Schlegel

early part of the movement, founded and edited the *Athenaeum* (1798–1810), the chief journal of the early German Romantic movement; see ROMANTICISM. As a critic, August von Schlegel was noted for the doctrine that the aim of literary criticism should be the understanding of the individuality and originality of a literary work rather than an evaluation based on the application of previously promulgated aesthetic standards. Schlegel's best-known and most influential work of literary criticism is *Lectures on Dramatic Art and Literature* (1809–11; Eng. trans., 1815). He was an outstanding translator, especially noted for his translations of seventeen of the plays of William Shakespeare (q.v.) made from 1797 to 1810. Through Schlegel's translations the plays became widely popular in Germany and had a great influence on German drama. His translations from the Spanish drama, *Spanisches Theater* (2 vol., 1803–09), first brought to the attention of the German public the works of the Spanish playwright Pedro Calderón de la Barca (q.v.). Other works of August von Schlegel include poetry and the drama *Ion* (1803). In addition to writing, he lectured on art and literature and was a professor at Bonn University between 1818 and 1845.

Friedrich von Schlegel (1772–1829), critic and philosopher, born in Hannover, and educated at

the universities of Göttingen and Leipzig. From about 1798 he was the leading philosopher of the early Romantic movement in German literature, expounding his ideas in the *Athenaeum*. He subsequently edited several other journals and also lectured on philosophy, history, and literature. Schlegel's most important work, *On the Speech and Wisdom of India* (1808), helped establish the modern science of comparative philology. He also published a number of his lectures, the novel *Lucinde* (1799; Eng. trans., 1913–15), and the tragedy *Alarcos* (1802).

SCHLEIDEN, Matthias Jakob (1804–81), German botanist, born in Hamburg, and educated in law at Heidelberg and botany and medicine at the universities of Göttingen, Berlin, and Jena. He served as professor of botany at the University of Jena from 1839 to 1863 and at the University in Dorpat (now Tartu, Estonian S.S.R.) from 1863 to 1864. Schleiden then retired from teaching to devote himself to botanical research. At a time when most botanists limited themselves to systematic botany, that is, the naming and describing of plants, Schleiden began examining plant tissue microscopically and discovered that plants are made up of cells; see CELL. His discovery led to the formulation of the celebrated cell theory (see EMBRYOLOGY) by the German physiologist Theodore Schwann (q.v.), which states that all living organisms are made up of cells. Schleiden also recognized the importance of the cell nucleus in the propagation of cells.

SCHLEIERMACHER, Friedrich Ernst Daniel (1768–1834), German theologian and philosopher, born in Breslau (now Wrocław, Poland). His early education was in Moravian schools, but he was later ordained in the Reformed Church. The strain of Pietism (q.v.) was strong in his writings, which also show the influence of the German Romantics, particularly Friedrich von Schlegel (see under SCHLEGEL). In 1809 he became pastor of Trinity Church in Berlin and dean of the theological school of the university in that city in 1810. Thereafter, for almost twenty-five years, he dominated Protestant thought in Germany; see THEOLOGY. Through his strong opposition to attitudes of the Enlightenment, which, he believed, confused the unique essence of religion with metaphysical questions and petty moralism, Schleiermacher became a major figure in the reform of Protestant theology; see ENLIGHTENMENT, AGE OF. Fundamental to his understanding of "cultural theology" was his recognition that the relationship between culture and faith was based upon the interactions and the eternal quality of the relationship be-

tween God and His world. Thus, religious life was participation with the eternal, rather than assent to a set of statements on ultimate questions. Among his works, some of which show a trace of the pantheism (q.v.) of the Dutch philosopher Baruch Spinoza (q.v.), are *Über die Religion: Reden an die Gebildeten unter ihren Verächtern* (1799; Eng. trans., *Religion: Speeches to Its Cultured Despisers*, 1893); *Monologen* (1800; Eng. trans., *The Soliloquies*, 1926); and *Der Christliche Glaube nach den Grundsätzen der evangelischen Kirche* (1821–22 and 1830–31; Eng. trans., *The Christian Faith*, 1928).

SCHLESINGER, name of two American historians who were father and son.

Arthur Meier Schlesinger (1888–1965), born in Xenia, Ohio, and educated at Ohio State and Columbia universities. He taught (1912–19) American history at Ohio State University, was (1919–24) professor and head of the history department at the State University of Iowa, now the University of Iowa, and then became (1924–54) professor of history at Harvard University. A member of many learned societies, in 1942 he was president of the American Historical Association. Schlesinger's works are notable for their keen insight into the sociological forces that shaped American history. They include *New Viewpoints in American History* (1922), *The Rise of the City* (1933), and *The Political and Social Growth of the American People, 1865–1940* (1941). With the American historian Dixon Ryan Fox (1887–1945), Schlesinger edited *A History of American Life* (13 vol., 1927–48).

Arthur Meier Schlesinger, Jr. (1917–), born in Columbus, Ohio, and educated at Harvard University. He was associate professor of history at Harvard from 1946 to 1954, and professor from 1954 to 1961. In 1952, 1956, and 1960 he was a campaign staff member for the Democratic Presidential candidate. When the successful 1960 candidate, John Fitzgerald Kennedy (q.v.), took office he appointed Schlesinger special assistant; and Schlesinger later wrote an account of the Kennedy administration, *A Thousand Days: John F. Kennedy in the White House* (1965, Pulitzer Prize for biography, 1966).

Schlesinger resigned in 1964, shortly after Kennedy's assassination, and in 1967 became professor of humanities at the City University of New York. He wrote *The Age of Jackson* (1945; Pulitzer Prize for history, 1946), *The Age of Roosevelt* (3 vol., 1957–60), *The Politics of Hope* (1963), *Bitter Heritage* (1967), and *The Imperial Presidency* (1973), a study of the gradual accrual of Presidential powers.

SCHLESWIG

SCHLESWIG, former duchy of Denmark. In 1864 it was wrested from Denmark by Prussia and Austria and two years later, following the Seven Weeks' War (q.v.), it was annexed to Prussia as part of the province of Schleswig-Holstein (q.v.). In 1919, after the end of World War I, a plebiscite was held in accordance with the Treaty of Versailles; as a result of the plebiscite, the n. part of Schleswig was incorporated into Denmark and the s. part into Germany. The Danish part of Schleswig is divided into the counties of Aabenraa-Sønderborg, Haderslev, and Tønder. *See* DENMARK: *History*; JUTLAND.

SCHLESWIG-HOLSTEIN, State of West Germany, bounded on the n. by Denmark, on the e. by the Baltic Sea and East Germany on the s. by the States of Hamburg and Lower Saxony, and on the w. by the North Sea. It includes a number of islands in the Baltic and North seas. Kiel is the capital and largest city. Lübeck and Flensburg are the other main cities. The State contains the lower half of the Jutland Peninsula which is part of the n. German plain. The low, harborless w. coast is mainly reclaimed marsh. The center of the peninsula is a sandy upland, which rises to the steep, rocky e. coast. This coast is cut by numerous long, narrow inlets. The main rivers are the Eider and the Elbe. The Nord-Ostsee Canal (q.v.) extends s.w. from Kiel Bay to the Elbe R. There are a number of lakes in the n.e. Area, 6046 sq.mi.; pop. (1971 est.) 2,543,200.

Agriculture is the chief economic activity, and wheat, rye, oats, barley, potatoes, and beets are the main crops. Schleswig-Holstein is famous

for its cattle, which are exported all over the world for breeding purposes. Poultry, horses, and sheep are also raised. Fishing is carried on extensively. Shipbuilding is one of the principal industries. Other major industries are machine construction, electrical engineering, and food processing.

Under the 1949 constitution, the State is governed by a cabinet, headed by a minister-president. The cabinet is responsible to a popularly elected diet.

History. The duchies of Schleswig and Holstein long figured prominently in the political history of n.w. Europe. The Danes always regarded Schleswig as Danish, and Holstein had at an early period become completely Germanized. In 1460 Schleswig and Holstein became allied to the Danish government when an heir to Schleswig and Holstein became Christian I (see under CHRISTIAN), King of Denmark. They remained legally separate, however, from Denmark. Frederick VII (q.v.), King of Denmark, in 1848 announced his intention of incorporating them into Denmark. The people of Schleswig-Holstein rebelled and appealed to Germany for military aid. Prussian troops and Schleswig-Holstein forces drove the Danes from Schleswig. In 1849 aided by Britain, Russia, and France, Denmark renewed the struggle, and eventually Prussia abandoned Schleswig-Holstein.

In 1864 German and Austrian forces advanced into Schleswig. Christian IX (see under CHRISTIAN), King of Denmark, had to relinquish his claims to Schleswig and Holstein. Under the terms of the Treaty of Vienna, written in 1864, the duchies of Schleswig and Holstein were

Kiel, the capital and chief port of Schleswig-Holstein.

German Tourist Information Office



ceded to Austria and Prussia; see VIENNA, TREATY OF. The terms of the Convention of Gastein in 1865 gave the administration of Schleswig to Prussia and that of Holstein to Austria. The ambitions of these rival powers soon led to the Seven Weeks' War (q.v.), which was followed by the formal incorporation of Schleswig-Holstein, including the former duchy of Lauenburg, as a province of Prussia.

Among the terms of the Treaty of Versailles following World War I was a provision calling for a plebiscite in Schleswig; see VERSAILLES, TREATY OF. The northern zone, which voted three to one for Denmark, was incorporated into Denmark. The southern zone voted overwhelmingly in favor of Germany, and became part of Schleswig-Holstein in Germany; see DENMARK: HISTORY; SCHLESWIG. At the end of World War II, German Schleswig-Holstein was included in the British Zone of Occupation, and became a State of the Federal Republic of Germany in 1949.

SCHLEY, Winfield Scott (1839–1911), American naval officer, born in Frederick County, Md. He graduated from the United States Naval Academy in 1860 and served on the Union side throughout the American Civil War. In 1884 he commanded the naval expedition that found American arctic explorer Adolphus Washington Greely (q.v.) and the six survivors of his party at Cape Sabine, Grinnell Land, in the Northwest Territories.

At the outbreak of the Spanish–American War (q.v.) in 1898, Schley was placed in command of the so-called Flying Squadron. Ordered to search for the Spanish fleet, he found and blockaded it in the harbor of Santiago de Cuba (q.v.). When the Spanish fleet was destroyed at the Battle of Santiago (q.v.) on July 3, 1898, Schley was in active command because the chief commander, Rear Admiral William Thomas Sampson (1840–1902) was temporarily absent. The question of whether Schley or Sampson deserved credit for the victory became the subject of bitter controversy. Schley received much public acclaim, however, and retired after the war as a rear admiral. Subsequently his conduct during the Battle of Santiago became the subject of so much criticism that he asked for a court of inquiry to investigate charges brought against him. The judgment of the court was that Schley's management of the engagement had been negligent.

SCHLIEMANN, Heinrich (1822–90), German archeologist, born in the duchy of Mecklenburg–Schwerin (now part of East Germany). As a boy he developed a love for Homeric (see HOMER) legend and a desire to prove its histori-

cal accuracy by archeological excavation. His formal education ended when he was apprenticed to a grocer at the age of fourteen. Subsequently he became a successful businessman in Russia and traveled widely; he became a United States citizen while he was in California in 1850, when that State joined the Union. He retired from business with a large fortune in 1863 and devoted himself and his fortune to the fulfillment of his boyhood dream.

In 1870 he began excavations on the hill of Hissarlik, in present-day Turkey, where he believed the remains of the ancient city of Troy (q.v.) would be found. He discovered several layers of cities and proclaimed the second city from the bottom to be the Homeric city of Troy. Later, however, it was discovered that the ruins were those of an even earlier settlement and that Homeric Troy was at a higher level. From 1876 to 1878 Schliemann excavated the tombs of the Mycenaean kings at Mycenae (q.v.), in Greece; see also MYCENAEAN ART AND ARCHITECTURE. Also in Greece, he made excavations at Ithaca (Itháki) in 1878 and at Orchomenus in 1881–82. In 1884–85 he unearthed the ruins of the great palace at Tiryns (q.v.), Greece. Because of Schliemann's discoveries, most scholars believe that Homer's account of the Trojan War (q.v.) is probably historically accurate.

SCHMALKALDIC LEAGUE, defensive alliance, organized by the German Protestant princes at Schmalkalden, Thuringia, February, 1531. Chief among the organizers were the future elector of Saxony John Frederick (1503–54) and the landgrave of Hesse Philip the Magnanimous (1504–67). The object of the alliance was the defense of the political freedom and religion of the Protestants against the power of Charles V (q.v.), Holy Roman Emperor. The league greatly aided the spread of the Reformation (q.v.) in Germany. In 1546, however, Charles declared war on the league and in 1547 he totally defeated the Protestant forces in a battle at Mühlberg, Saxony.

SCHNABEL, Artur (1882–1951), Austrian pianist, composer, and teacher, born in Lipník (now in Czechoslovakia). He studied music in Vienna under the Polish pianist Theodor Leschetizky (q.v.). From 1919 to 1933 Schnabel taught at the Hochschule für Musik in Berlin. During this time he made several concert tours, and in 1938 he settled in the United States. As a performer, Schnabel was particularly well known for his interpretations of the sonatas and concertos of the German composer Ludwig van Beethoven (q.v.), and he prepared a new edition of the Beethoven piano sonatas (1936). With the Hun-

SCHNAUZER

giant violinist Karl Flesch (1873–1944), he wrote the violin sonatas of the composers Wolfgang Amadeus Mozart, of Austria, and of Johannes Brahms (q.v.), of Germany. Schnabe's compositions include three symphonies for orchestra, several chamber works, and *Rhapsody* (1948).

SCHNAUZER. dog existing in three varieties, giant, standard or medium-sized, and miniature; the giant and standard schnauzers are working dogs, the miniature is a terrier. The earliest of the three varieties to develop was the standard schnauzer, which originated several hundred years ago in Württemberg and Bavaria, Germany. This type of schnauzer, 17 to 20 in. high at the shoulder, was first used as a sheep dog. In recent times it has been used in Germany as a watchdog and for police work, and in warfare as a Red Cross aid and for carrying dispatches. In order to obtain a larger-sized dog with the same general characteristics as the medium-sized schnauzer, the inhabitants of Swabia, in the south of Bavaria, crossed the medium-sized schnauzer with larger dogs, including the black great Dane. The result of these crossings, the giant schnauzer, 21½ to 25½ in. high at the shoulder, was at first used for cattle driving; in the first half of the 20th century it was used in Germany chiefly as a watchdog for large industrial plants and for police work. The miniature schnauzer was derived toward the end of the 19th century from the standard-sized schnauzer by crossing small specimens of the standard with a small black breed of German dog known as the Affenpinscher. The miniature, about 12½ in. high at the shoulder, is used chiefly as a pet; it has become fairly popular in the United States since about 1933. The characteristics of the three varieties are similar. The schnauzer has an elongated head; dark-brown oval-shaped eyes under heavy eyebrows; small, v-shaped ears; a fairly broad chest; and a tail 1 or 2 in. long. The

dog has a hard, wiry coat which is pepper-and-salt in color (small black and white spots intermingled), black and tan, or solid black.

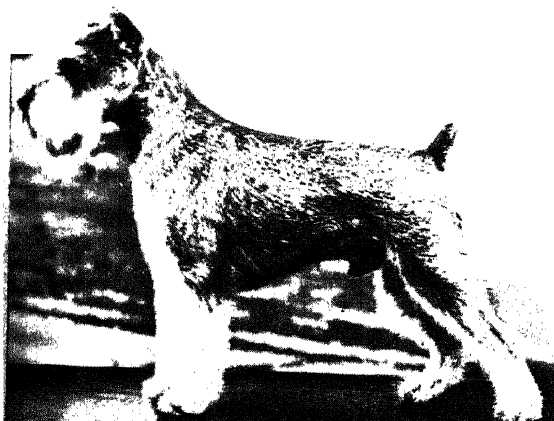
SCHNITZLER, Arthur (1862–1931), Austrian physician, dramatist, and novelist, born in Vienna. He studied medicine at the University of Vienna and was a practicing physician until 1894, when he began to devote himself exclusively to writing. Schnitzler is generally regarded as one of the foremost impressionist writers in German literature. In 1891 he formed the so-called Young Vienna group with the Austrian poet and dramatist Hugo von Hofmannsthal (q.v.) and several other contemporary writers.

Neither religious nor idealistic, Schnitzler produced striking works in a lucid, serene style, dealing with three recurrent themes, human relationships, injustice and prejudice, and fear of old age and death. He explored the problems of the relationship between man and woman in plays such as *Anatol* (1893; Eng. trans., 1914), and *Reigen* (1920, known as *La Ronde*), all of which are set against the background of the sensuous, romantic life of his contemporary Viennese. Schnitzler chronicled the anti-Semitism prevalent in his time in the novel *Der Weg ins Freie* (1908; Eng. trans., *The Road to the Open*) and the tragedy *Professor Bernhardi* (1912; Eng. trans., 1913). As Schnitzler approached middle age, he became obsessed with the fear of old age and death and this was reflected in his novels *Beatrice* (1913) and *Casanova's Heimfahrt* (*Casanova's Homecoming*, 1918).

Schnitzler was in close contact with the renowned Austrian physician and founder of psychoanalysis, Sigmund Freud (q.v.), with whom he shared many medical and psychological opinions. Among Schnitzler's other works are *Der grüne Kakadu* (1899; Eng. trans., *The Green Cockatoo*), *Leutnant Gustl* (1901; Eng. trans., *None but the Brave*, 1926), *Fraülein Else* (1924; Eng. trans., 1925), and *Rhapsody* (1925). See GERMAN LITERATURE: *Naturalism*.

SCHOFIELD, John McAllister (1831–1906), American army officer, born in Gerry, N.Y., and educated at the United States Military Academy, where he taught from 1855 to 1860. In 1861, at the beginning of the American Civil War, he joined the Union forces and received a commission as a major in a regiment of Missouri volunteers. He received several promotions during the war. In 1864 he commanded the XXIII Corps and the Army of the Ohio in the Atlanta campaign of Union general William Tecumseh Sherman (see under SHERMAN). Later that year, in Tennessee, Schofield opposed Confederate general John Bell Hood (q.v.) at the battles of

Miniature schnauzer



Franklin and Nashville; see FRANKLIN, BATTLE OF; NASHVILLE, BATTLE OF.

After the war, in 1868–69, Schofield served as secretary of war under President Andrew Johnson (q.v.). In 1872 he was sent on a mission to the Hawaiian Islands, and his recommendations subsequently led to the establishment of Pearl Harbor as an American naval base. From 1876 to 1881 he was superintendent of the U.S. Military Academy, and in 1888 he was appointed commanding general of the U.S. Army. He retired in 1895 with the rank of lieutenant general. Schofield wrote an autobiography, *Forty-Six Years in the Army* (1897).

SCHOLASTICISM, philosophical and theological movement which was dominant in the medieval Christian schools and universities of Europe from about the middle of the 11th century to about the middle of the 15th century. Scholasticism attempted to use natural human reason and, in particular, the philosophy and science of the Greek philosopher Aristotle to understand the supernatural content of Christian revelation. The ultimate ideal of the movement was to integrate into an ordered system both the natural wisdom of Greece and Rome and the religious wisdom of Christianity. The term "Scholasticism" is used also in a wider sense to signify the spirit and methods characteristic of this period of thought, or any similar spirit and attitude toward learning found in other periods of history. The term "Scholastic", which originally designated the heads of the medieval monastic or cathedral schools from which the universities developed, finally came to be applied to anyone teaching philosophy or theology in such schools or universities.

Principal Characteristics. Scholastic thinkers held a wide variety of doctrines in both philosophy and theology. What gives unity to the whole Scholastic movement are the common aims, attitudes, and methods generally accepted by all its members. The chief concern of the Scholastics was not to discover new facts but to integrate the knowledge already acquired separately by Greek reasoning and Christian revelation. This concern is one of the most characteristic differences between Scholasticism and modern thought since the Renaissance.

The basic aim of the Scholastics determined certain common attitudes, the most important of which was the conviction of the fundamental harmony between reason and revelation. The Scholastics maintained that the same God was the source of both types of knowledge and that truth was one of His chief attributes, so that He could not contradict Himself in these two ways

of speaking to men. Any apparent opposition between revelation and reason could be traced back either to an incorrect use of reason or to an inaccurate interpretation of the words of revelation. Because the Scholastics believed that revelation was the direct teaching of God Himself, it possessed for them a higher degree of truth and certitude than did natural reason. In apparent conflicts between religious faith and philosophical reasoning, faith was thus always the supreme arbiter; the theologian's decision overruled that of the philosopher. After the early-13th century, Scholastic thought emphasized more the independence of philosophy within its own domain. Nonetheless, throughout the Scholastic period philosophy was called the handmaid of theology, not only because the truth of philosophy was subordinated to that of theology, but also because the theologian used philosophy to understand and explain revelation.

This attitude of Scholasticism stands in sharp contrast to the so-called double-truth theory of the Spanish-Arabian philosopher, jurist, and physician Averroës. His theory assumed that truth was accessible to both philosophy and Muslim theology but that only philosophy could attain it perfectly. The so-called truths of theology served, hence, as imperfect imaginative expressions for the common people of the authentic truth accessible only to philosophy. Averroës maintained that philosophical truth could even contradict, at least verbally, the teachings of Muslim theology.

As a result of their belief in the harmony between faith and reason, the Scholastics attempted to determine the precise scope and competence of each of these faculties. Many early Scholastics, such as the Italian ecclesiastic and philosopher Saint Anselm of Canterbury, did not clearly distinguish the two and were overconfident that reason could prove certain doctrines of revelation. Later, at the height of the mature period of Scholasticism, the Italian theologian and philosopher Saint Thomas Aquinas worked out a balance between reason and revelation. Scholastics after Aquinas, however, beginning with the Scottish theologian and philosopher John Duns Scotus, restricted more and more the domain of truths capable of being proved by reason and insisted that many doctrines previously thought to have been proved by philosophy had to be accepted on the basis of faith alone. One reason for this restriction was that Scholastics applied the requirements for scientific demonstration, as first specified in Aristotle's *Organon*, much more rigorously than

previous philosophers had done. These requirements were so strict that Aristotle himself was rarely able to apply them fully beyond the realm of mathematics. It was this trend that led finally to the loss of confidence in natural human reason and philosophy that is characteristic of the early Renaissance and of the first Protestant religious reformers, such as the German theologian Martin Luther.

Another common attitude among Scholastics was their great respect for the so-called authorities in both philosophy and theology. These authorities were the great philosophers of Greece and Rome and the early Christian Fathers of the Church (see *Logic*). The medieval Scholastics educated themselves to think and write only by intensive study of these ancient authors, whose culture and learning had been so much richer than their own. After they had reached their full maturity of thought and had begun to create original works of philosophy, they continued the practice of quoting authorities to lend weight to their own opinions, even though the latter were reached, in many cases, quite independently. Later critics concluded from this practice that the Scholastics were mere compilers or repeaters of their authorities. As a matter of fact, the mature Scholastics, including Aquinas and Duns Scotus, were extremely flexible and independent in their use of the texts of the ancients; frequently, in order to bring the texts into harmony with their own positions, they rendered interpretations that were difficult to reconcile with the ancients' intentions. The appeal to authority was often little more than an ornament of style for beginning or ending the exposition of the commentator's own opinions, and was designed to show that his views were in continuity with the past and not mere novelties. Novelty and originality of thought were not sought deliberately by any of the Scholastics but rather were underplayed as much as possible.

The Scholastics considered Aristotle the chief authority in philosophy, calling him simply "the Philosopher". The early Christian prelate and theologian Saint Augustine was their principal authority in theology, subordinate only to the Bible and the official councils of the Church; see *Council*. The Scholastics adhered most closely and uncritically to authority in accepting Aristotle's opinions in the empirical sciences such as physics, astronomy, and biology. Their uncritical acceptance of Aristotle's scientific views produced a serious weakness in Scholasticism, and was one of the principal reasons for its scornful rejection by scientists during the Renaissance and later.

Common Methods. One of the principal methods of Scholasticism was the use of the logic and the philosophical vocabulary of Aristotle in teaching, demonstration, and discussion. Another important method was the practice of teaching a text by means of a commentary by some accepted authority. In philosophy this authority was usually Aristotle. In theology the principal texts were the Bible and the *Sententiarum Libri Quatuor* ("Four Books of Sentences") by the Italian theologian and prelate Peter the Lombard (1100?–60), a collection of the opinions of the early Fathers of the Church on various problems of theology. The early Scholastics began by adhering closely to the text on which they were commenting. Gradually, as this practice of critical reading developed their own powers of thinking, they began to introduce many supplementary commentaries on points, known as disputed questions, which either were not covered or were not adequately solved by the text itself. Beginning in the 13th century these supplementary commentaries, embodying the personal thought of the teachers, became the largest and most important part of the commentaries, with the result that literal explanation of the text was reduced to a mere fraction of each commentary.

Closely allied with the commentaries on disputed questions was the technique of discussion by means of public disputation. Every professor in a medieval university was required to appear several times a year before the assembled body of faculty and students in a disputation, defending crucial points of his own teaching against all persons who challenged them. The forms of Aristotelian logic were employed both in defense and in attack; see *Logic*. In the 13th century the public disputation became a flexible educational tool for stimulating, testing, and communicating the progress of thought in philosophy and theology. After the middle of the 14th century, however, the vitality of public disputation declined, and it became a rigid formalism. Disputants became concerned less with real content and more with fine points of logic and minute subtleties of thought. This degraded form of disputation did much to give Scholasticism a bad reputation during the Renaissance and later, so that many modern thinkers have considered it to be merely pedantic logical formalism.

Principal Scholastic Philosophers. The outstanding Scholastics of the 11th and 12th centuries included Saint Anselm of Canterbury, the French philosopher, theologian, and teacher of logic Peter Abelard, and the philosopher and

pergaman Roscellinus (d. after 1120), who founded the school of philosophy known as nominalism (q.v.). Among Jewish thinkers of the same period, the Jewish rabbi, philosopher, and physician Maimonides attempted to reconcile Aristotelian philosophy with divine revelation, as understood in Judaism, in a spirit similar to that of the Christian Scholastics. The Scholastics of the so-called golden age of the 13th century include Aquinas and the German philosopher Saint Albertus Magnus, both of the Dominican Order; the English monk and philosopher Roger Bacon, the Italian prelate and theologian Saint Bonaventura, and Duns Scotus, all of the Franciscan Order; and the Belgian secular priest Henry of Ghent (d. 1293). Nominalism became the dominant school of philosophy in the 14th century, when Scholasticism began to decline. The most important nominalist was the English philosopher William of Ockham, a great logician who attacked all the philosophical systems of the preceding Scholastics and maintained that natural reason and philosophy had a much more restricted field of operation than his predecessors had held to be the case.

A brilliant but brief revival of Scholasticism especially in the field of theology, took place in Spain in the 16th century, chiefly among the Dominicans (q.v.), as exemplified by the Spanish theologian Francisco de Vitoria (1483?–1546), and the Jesuits (q.v.), as exemplified by the Spanish theologian and philosopher Francisco Suárez (1548–1617). A more widespread revival was launched by Pope Leo XIII (see *under* LEO) in 1879 with the purpose of reconsidering, in the light of modern needs, the great Scholastic systems of the 13th century, especially that of Aquinas, and of incorporating in a modern reformulation of those systems all the genuine contributions of modern thought. This revival, often called neo-scholasticism, is one of the established currents of contemporary thought. The principal exponents of neo-scholasticism include the French philosopher and diplomat Jacques Maritain and the French philosopher and historian of philosophy Étienne Henri Gilson (1884–).

For a detailed history of Scholastic philosophy, see PHILOSOPHY: *Scholasticism and Medieval Philosophy after Aquinas*.

See separate biographies of persons whose life and death dates are not given. W.N.C.

SCHÖNEBERG, Arnold, or SCHOENBERG, ARNOLD (1874–1951), Austrian-American composer, musical theorist, and teacher, born in Vienna, and educated at the Vienna Realschule. Almost entirely self-taught in musical theory,

Schönberg lived in Vienna, composing and teaching, until 1933, when he settled in the United States. From 1936 to 1944, he was professor of music at the University of California at Los Angeles. After he became a U.S. citizen in 1941, he changed the spelling of his name to Schoenberg.

Schönberg's first important compositions were the string sextet *Verklärte Nacht* ("Transfigured Night", 1899) and a large work for solo voices, chorus, and orchestra, *Gurrelieder* ("Songs of Gurra", 1901–02). These compositions are characterized by sensuous melody and a rich harmonic texture, and show the influence of the German composers Richard Wagner and Richard Strauss and of the Austrian composer Gustav Mahler (qq.v.). In succeeding works, such as the symphonic poem *Pelléas et Mélisande* (1905) and the String Quartet in D minor (1907), Schönberg began to break with tradition, and traces of his later experimental style became apparent. About 1908 he abandoned completely the traditional concepts of tonality (q.v.) and began to compose atonal music (see ATONALITY). Among his earliest atonal works are *Erwartung* ("Awakening", 1909), an opera for a single voice and orchestra, and *Pierrot Lunaire* ("Moonstruck Pierrot", 1912), a song cycle for voice, piano, flute, clarinet, violin, and cello.

About 1910, Schönberg began to formulate a theoretical basis for the methods of atonal composition he had originated. Over a period of about ten years, he developed the twelve-tone system (q.v.), also known as serialism, a method of composition according to which all his later works and those of his leading disciples, the Austrian composers Alban Berg and Anton von Webern (qq.v.), were created. Schönberg first employed the twelve-tone technique in such works as *Fünf Klavierstücke* ("Five Piano Pieces", 1923) and *Suite für Klavier* ("Suite for Piano", 1924). His other important works include *Orchestral Variations* (1928), Violin Concerto (1936), Piano Concerto (1942), the cantata *A Survivor from Warsaw* (1947), and the unfinished opera *Moses und Aaron* (1932–51).

Schönberg expounded his theory of harmony in the treatise *Harmonielehre* (1911; Eng. trans., *Theory of Harmony*, 1947). He also published a volume of essays, *Style and Idea* (1950).

SCHÖNEBERG, residential area in West Germany, a district of West Berlin, Germany, s.w. of the city center. A rail junction, the district manufactures radios, electrical equipment, and apparel. Since World War II it has been the administrative center of the city; the Berlin senate meets in the town hall. In the building are the

Freedom Bell, a gift of the United States in 1951, and the Freedom Scroll, signed by 17,000,000 Americans. Also in the district are institutes of economics and science and a college of political science.

SCHONGAUER, Martin, also known as MARTIN SCHÖN and as HIPSCH MARTIN or HÜBSCH MARTIN (1445?-91), German painter and engraver, born in Colmar, Alsace (now in France), where he spent most of his life. Little is known of his life and most of his works are not authenticated or precisely datable. His late-Gothic paintings show the strong influence of Flemish painters, especially Rogier van der Weyden (q.v.). Although he painted prolifically, only a few of Schongauer's canvases have survived. Of these his masterpiece is "Madonna of the Rose Hedge", also known by the title "Virgin and Child in a Rose Garden", a monumental sensitive altarpiece, executed in 1473 for the Church of Saint Martin in Colmar.

Schongauer is best known for his monogrammed copper engravings, which show a special richness and maturity because of his knowledge of painting. He was the first and foremost engraver of his time in northern Europe and his ornamental designs greatly influenced the de-

velopment of German art, particularly the work of the later German painter and engraver Albrecht Dürer (q.v.); see GERMAN ART AND ARCHITECTURE. His engravings, all of religious subjects, exhibit fine detail, economy of composition, and a greater range of light-and-shadow contrasts and textures than had previously been used. Among his best-known engravings are "Death of the Virgin", one of his large, early works, and "Passion of Christ", a set of twelve engravings executed, later in life when he had turned to work on smaller plates. More than 100 of the 115 engravings he executed have survived, and many are in museums in Europe and the United States.

SCHOOLCRAFT, Henry Rowe (1793-1864), American explorer and ethnologist, born in Watervliet, N.Y., and educated at Middlebury College in Vermont, and Union College (now Union College and University in Schenectady, N.Y.). In 1817-18 he made explorations in Missouri and Arkansas, gathering geological, geographical, and mineralogical information. He served as geologist on the expedition led by the American general Lewis Cass (q.v.) in 1820 which explored the Lake Superior region. From 1822 to 1836 Schoolcraft served as Indian agent



Engraving by Martin Schongauer, "Christ Appearing to Mary Magdalene" (about 1477).

Metropolitan Museum of Art -
Dick Fund

the tribes of that region and from 1836 to 1842 as superintendent of Indian affairs for Michigan. In 1832 he led the expedition that discovered the sources of the Mississippi R. Schoolcraft devoted much of his life to the study of the American Indians and was one of the first to write about their culture. His most important work is the monumental study *Historical and Statistical Information Respecting the History, Condition, and Prospects of the Indian Tribes of the United States* (6 vol., 1851–57).

SCHOONER. See SAIL; SHIPS AND SHIPBUILDING: *Early Types of Vessels*.

SCHOPENHAUER, Arthur (1788–1860), German philosopher, born in Danzig (now Gdańsk, Poland), and educated at the universities of Göttingen, Berlin, and Jena. He then settled in Frankfurt-am-Main, where he led a solitary life



Arthur Schopenhauer

Bettmann Archive

and became deeply involved in the study of Buddhist and Hindu philosophies and mysticism (q.v.); see BUDDHISM; HINDUISM. He was also influenced by the ideas of the German Dominican theologian, mystic, and eclectic philosopher Johannes Eckhart (1260?–1327), and the German theosophist and mystic Jakob Böhme (q.v.), and the scholars of the Renaissance and the Age of Enlightenment; see ECLECTICISM; ENLIGHTENMENT, AGE OF; RENAISSANCE. In his principal work, *Die Welt als Wille und Vorstellung* (1819; Eng. trans., *The World as Will and Idea*, 1883), he proposed the dominant ethical and metaphysical elements of his atheistic and pessimistic philoso-

phy; see ATHEISM; ETHICS; METAPHYSICS; PESSIMISM.

Schopenhauer disagreed with the school of idealism (q.v.), and was strongly opposed to the ideas of the German philosopher Georg Wilhelm Friedrich Hegel (q.v.), who believed in the spiritual nature of all reality. Instead, Schopenhauer accepted, with some qualification in details, the view of the German philosopher Immanuel Kant (q.v.) that phenomena exist only insofar as the mind perceives them, as ideas. He did not, however, agree with Kant that the "thing-in-itself" (*Ding an sich*), or the ultimate reality, lies hopelessly beyond experience. He identified it with experienced will instead. According to Schopenhauer, however, will is not limited to voluntary action with foresight; all the experienced activity of the self is will, including unconscious physiological functionings. This will is the inner nature of each experiencing being and assumes in time and space the appearance of the body, which is an idea. Starting from the principle that the will is the inner nature of his own body as an appearance in time and space, Schopenhauer concluded that the inner reality of all material appearances is will; the ultimate reality is one universal will.

For Schopenhauer the tragedy of life arises from the nature of the will, which constantly urges the individual toward the satisfaction of successive goals, none of which can provide permanent satisfaction for the infinite activity of the life force, or will. The will, thus, inevitably leads man to pain, suffering, and death, and into an endless cycle of birth, death, and rebirth, and the activity of the will can only be brought to an end through an attitude of resignation, in which the reason governs the will to the extent that striving ceases, as in the lives of the true saints.

This conception of the source of life in will came to Schopenhauer through insight into the nature of consciousness as essentially impulsive. Essentially, he revealed a strong Buddhist influence in his metaphysics, and a successful confluence of Buddhist and Christian ideas in his ethical doctrines. From the epistemological point of view, his ideas belonged to the school of phenomenology (q.v.); see EPISTEMOLOGY.

Renowned for his hostile attitude toward women, Schopenhauer subsequently applied his insights to a consideration of the principles underlying human sexual activity, noting that individuals are driven together not by feelings of sentimental love but by the irrational impulses of the will. The influence of Schopenhauer's philosophy may be seen in the early works of the German philosopher and poet Friedrich Wilhelm Nietzsche, the music dramas

SCHOUTEN

of the German composer Richard Wagner (qq.v.) and in much of the philosophical and artistic work of the 20th century. See PHILOSOPHY: *Modern Philosophy*.

SCHOUTEN, Willem Cornelis (1567?–1625), Dutch navigator, born in Hoorn. He organized (1613) a company that sought a new route from Europe to the East Indies to evade the Dutch East India Company monopoly on the usual course around the Cape of Good Hope, Africa. In 1616 Schouten was the first to sail around the southern tip of South America, and he named it Cape Horn, in honor of his birthplace. After rounding the cape he crossed the Pacific Ocean, finally reaching Batavia (now Djakarta), on the island of Java, in present-day Indonesia.

SCHRIEFFER, John Robert (1931–), American physicist, born in Oak Park, Ill., and educated at Massachusetts Institute of Technology and the University of Illinois. After teaching at the universities of Chicago (1957–59) and Illinois (1959–62), he joined the faculty of the University of Pennsylvania (1962). The 1972 Nobel Prize in physics was awarded to Schrieffer and two American physicists, John Bardeen and Leon N. Cooper (qq.v.). They were cited for the development of a theory to explain the disappearance of electrical resistance in certain metals and alloys at temperatures near absolute zero, a phenomenon known to scientists as superconductivity.

SCHRÖDINGER, Erwin (1887–1961), Austrian physicist, born in Vienna, and educated at the University of Vienna. He taught physics successively at the universities of Stuttgart, Breslau, Zürich, Berlin, Oxford, and Graz. He was director of the school of theoretical physics of the Institute of Advanced Study in Dublin from 1940 until his retirement in 1955. Schrödinger shared the 1933 Nobel Prize in physics with the British physicist Paul A. M. Dirac (q.v.) for his contribution to the development of quantum mechanics (q.v.). His research included important work on atomic spectra, statistical thermodynamics, and wave mechanics; see SPECTRUM; THERMODYNAMICS; WAVE MOTION.

Among Schrödinger's books are *Collected Papers on Wave Mechanics* (1928), *Modern Atomic Theory* (1934), *Statistical Thermodynamics* (1945), and *Expanding Universes* (1956).

SCHUBERT, Franz Peter (1797–1828), Austrian composer, born in Vienna. The son of a parish schoolmaster, he became a choirboy in the Imperial Chapel in 1808 and began studies at the Konvikt, the school for court singers. He played violin in the school orchestra.

Schubert's Earliest Works. His first songs,



Franz Schubert

among them "Hagars Klage" ("Hagar's Lament", 1811) and "Der Vatermörder" ("The Patricide", 1811), greatly impressed his teachers. When his voice changed in 1813, Schubert left the Konvikt and began teaching in his father's school. The following year, he wrote his first opera, *Des Teufels Lustschloss* ("The Devil's Pleasure-Castle"); his first mass, in F major; and 17 songs, including such masterpieces as "Der Taucher" ("The Diver") and "Gretchen am Spinnrade" ("Gretchen at the Spinning Wheel"). In 1815 he completed his second and third symphonies and wrote 2 masses, in G and B flat major, other sacred works, some chamber music, and 146 songs, including "Der Erlkönig" ("The Erl King"), based on a mythological figure of death. That year, he also worked on 5 operas. In 1816 he wrote his Symphony in C minor, known as the *Tragic Symphony*, the Symphony in B flat major, additional sacred music, an opera, and more than 100 songs. About this time Schubert gave up teaching, devoting himself exclusively to composition. Not a success with the general public during his lifetime, Schubert was recognized as a composer of genius by a small circle of friends, among them the poet and playwright Franz Grillparzer (q.v.) and the singer Johann Michael Vogl (1768–1840).

Schubert's Wide Range of Composition. He wrote (1820) music for *Die Zauberharfe* ("The Magic Harp"), a melodrama, and *Die Zwillings-*

brother ("The Twin Brothers", 1820), an unsuccessful operetta. He also composed sacred music such as the *Twenty-Third Psalm* and the unfinished oratorio *Lazarus*. A group of his songs was published in 1821. In 1822 he wrote the Symphony in B minor, known as the *Unfinished Symphony*, and the mass in A flat. His song cycle *Die Schöne Müllerin* ("The Miller's Beautiful Wife") was composed in 1823 and the *Octet* and *Songs from Sir Walter Scott* in 1824. For the next two years Schubert wrote constantly, producing the *Winterreise* ("Winter's Journey") songs in 1827. The Seventh Symphony in C major, the mass in E flat major, the String Quintet in C major, his last three piano sonatas, and his last and greatest collection of songs, *Schwanengesang* ("Swan Song"), were written in 1828, the year of his death.

Evaluation. Schubert was the only 19th-century composer who successfully combined Romanticism with the older classical traditions. Even his early instrumental works, which follow the patterns used by the composers Wolfgang Amadeus Mozart and (Franz) Joseph Haydn (q.q.v.), are marked as Romantic by a new sonority and a harmonic and melodic richness. In his early piano sonatas, Schubert worked to free himself from the influence of the German composer Ludwig van Beethoven (q.v.). Despite certain great movements, the works frequently lack clarity, are overly discursive, and in their development sections rarely achieve the dramatic tension that is the core of the classical sonata (q.v.) form.

Schubert's instrumental works show development over a long period of time, but some of his greatest songs were composed before he was twenty years old. In Schubert's songs the literary and musical elements are perfectly balanced, composed on the same intellectual and emotional level. Although Schubert composed strophic songs throughout his career, he did not follow set patterns but exploited bold and free forms when the text demanded it. His reputation as the father of German *lieder* ("art songs") rests on a body of more than 600 songs; see *SONG*.

SCHULBERG, Budd Wilson (1914–), American novelist, short-story writer, and screenwriter, born in New York City. He grew up in Hollywood, Calif., where through his father, Benjamin P. Schulberg (1892–1957) a pioneering motion picture producer, he gained valuable exposure to the film industry. After graduation from Dartmouth College in 1936, he returned to Hollywood, where he wrote for motion pictures from 1937 to 1939, at the same time publishing

short stories in major magazines. His first and widely read full-length novel, *What Makes Sammy Run?*, appeared in 1941. During World War II Schulberg served in the Office of Strategic Services in Washington, D.C., and he was later in charge of photographic evidence at the Nuremberg trials; see *WAR-CRIMES TRIALS: Nuremberg Trials*.

Schulberg's fiction, characterized by hard realism and authentic dialogue, has the recurrent theme of success and disenchantment. His works include the novels *The Harder They Fall* (1947) and *The Disenchanted* (1950) and the short stories *Some Faces in the Crowd* (1953).

His original screenplay for *On the Waterfront* received an Academy of Motion Picture Arts and Sciences award in 1954. He also wrote the scenarios for *From the Ashes—Voices of Watts* (1967) and *Sanctuary V* (1969), and the biography *Loser and Still Champion: Muhammad Ali* (1972).

SCHUMAN, Robert. See *EUROPEAN COAL AND STEEL COMMUNITY*; *FRANCE: History: The Fourth Republic*.

SCHUMAN, William (1910–), American composer and educator, born in New York City and educated at Columbia University. He studied music under the American composers Charles Haubiel (1892–) and Roy Harris (q.v.) and won many prizes and commissions, among them two Guggenheim Fellowships (1939–41) and the first Pulitzer Prize in music (1943). He taught at Sarah Lawrence College from 1935 to 1945 and was president of the Juilliard School of Music from 1945 to 1962. From 1962 to 1968 he was president of Lincoln Center for the Performing Arts (q.v.) in New York City.

Schuman's music has a vigorous, rhythmic, and harmonic structure, with strong melodic lines that always prevail, despite his frequent use of polytonality, that is, two or more musical keys occurring simultaneously. Many of his larger works contain preclassical forms such as the fugue (q.v.) and passacaglia, slow music based on a Spanish dance. Among his compositions are *American Festival Overture* (1939) for orchestra; a concerto (1942) for piano and small orchestra; *William Billings Overture* (1943); the ballets *Undertow* (1945) and *Night Journey* (1947); the one-act opera *The Mighty Casey* (1953); and *A Song of Orpheus* (1961) for cello and orchestra. He also composed nine symphonies, four string quartets, other choral works, and scores for motion pictures. See *AMERICAN MUSIC: Musical Independence*.

SCHUMANN, name of two 19th-century German musicians who were husband and wife.



Robert Schumann

Robert Schumann (1810–56), composer born in Zwickau, Saxony, and educated at the universities of Leipzig and Heidelberg. The son of a bookseller, he early became absorbed in literature, particularly that of Romanticism (q.v.). In 1830 he abandoned the study of law in order to devote himself to music. He studied piano with the German teacher Friedrich Wieck (1785–1873), but a permanent injury to one of his fingers forced him to abandon the career of pianist. He then turned to composition and the writing of musical essays. In 1834, he founded the music journal *Neue Zeitschrift für Musik*, which he edited until 1844. His marriage to the daughter (see below) of his former teacher, took place in 1840. In 1843 Schumann was appointed to the faculty of the newly founded Leipzig Conservatory, but finding himself emotionally unfit for teaching, he soon resigned. In 1850 he was named town music director at Düsseldorf; advancing mental illness forced him to resign, however, in 1854, the year in which he attempted suicide. He then was confined to an asylum near Bonn, where he died two years later.

Schumann, one of the most typical of Romantic composers, characterized himself in two imaginary figures, the forceful Florestan and the poetic Eusebius, whose names he signed to his critical articles and whose musical portraits he drew in his piano suite *Carnaval* (1834–35). In the year 1840, he achieved what generally is considered his greatest work when he suddenly turned to the song form. In that year he composed 138 songs of the finest quality, among

them the great song cycles *Liederkreis* (two cycles, texts by Heinrich Heine, q.v.), *Märchen* (texts by various poets), *Frauenliebe und Leben* ("Woman's Love and Life", text by Adelbert von Chamisso, q.v.), and *Dichterliebe* ("Poet's Love", text by Heinrich Heine). Schumann concentrated on the psychological subtleties of a poem and in his songs gave to the piano accompaniment an equal role in expressing the mood and meaning of a poem.

Schumann's piano works are largely musical expressions of literary themes and moods. With the exception of the *Fantasy in C major* (1836) and *Études Symphoniques* (1854), his best piano compositions consist of cycles of short pieces in which a single lyrical idea is brought to completion within a small framework. In addition to *Carnaval*, they include *Papillons* ("Butterflies", 1820–31), *Kinderszenen* ("Scenes from Childhood", 1838), *Kreisleriana* (1838), and *Album für die Jugend* ("Young People's Album", 1848).

Although Schumann rarely achieved in his larger works the unity of form to be found in his songs and piano pieces, they do contain much that is beautiful and dramatic. This is particularly true of the *First Symphony* (1841), *Piano Quintet* (1842), *Piano Concerto* (1845), *Second Symphony* (1846), and *Piano Trio* (1847). Among his other compositions are a choral work, *Das Paradies und die Peri* ("Paradise and the Peri", 1843), and an unsuccessful opera, *Genoveva* (1847–48).

Clara Josephine Schumann (1819–96), pianist, born Clara Wieck in Leipzig, and trained by her father. A pianist from the age of eight, she was already well known in Europe when, in 1840, she married Robert Schumann over the strenuous objections of her father. She introduced many of Schumann's piano works, including the *Piano Concerto* (1845). After Schumann's death, she became one of the great pianists of her time, touring almost constantly attempting to promote the works of the great composers for the piano. She did much to make popular the music of her lifelong friend, the German composer Johannes Brahms (q.v.). She edited the complete works of Schumann and from 1872 to 1892 taught at the Hoch Conservatorium in Frankfurt.

SCHUMANN-HEINK, Ernestine (1861–1936), Austrian-American contralto, born Ernestine Roessler in Lieben (now part of Prague, Czechoslovakia), and trained in Germany. She made her concert debut in 1876 and her operatic debut at Dresden in 1878. Her American debut was in Chicago in 1898 in the role of Ortrud in *Lohengrin* by the German composer

Richard Wagner (q.v.). She joined the Metropolitan Opera Company (q.v.) in New York City in 1899 and continued to perform there until 1932. After 1909 she specialized in concert work, making many nationwide tours. Her rich, powerful voice and extraordinary range, at all registers showing an even quality, particularly qualified her for Wagnerian roles and made her one of the foremost singers of her time.

SCHUMAN PLAN. See EUROPEAN COAL AND STEEL COMMUNITY.

SCHUMPETER, Joseph Alois (1883–1950), Austrian-American economist and social theorist, born in Triesch, Moravia (now Czechoslovakia), and educated at the University of Vienna. He began to practice law in Vienna in 1907 and after winning recognition as an economic theorist, he taught economics for various periods at the universities of Vienna, Gernowitz (now Chernovtsy, U.S.S.R.), Graz, and Bonn after 1909. After visiting the United States as an exchange professor at Columbia University in 1913 and at Harvard University in 1927 and 1931, he received a permanent faculty appointment at Harvard in 1932. He remained at Harvard for the rest of his career, and achieved prominence for his theories about the vital importance of the entrepreneur in business, and his role in stimulating investment and innovation, which determined the rise and ebb of prosperity. Schumpeter also predicted the sociopolitical disintegration of capitalism (q.v.), which, he maintained, would be undermined eventually by its own successes. His best known books are *The Theory of Economic Development* (1911; Eng. trans., 1934), *Business Cycles* (1939), *Capitalism, Socialism, and Democracy* (1942), and *The History of Economic Analysis*, published posthumously in 1954.

SCHURZ, Carl (1829–1906), German-born American army officer, legislator, and journalist, born near Cologne, and educated at the University of Bonn. He was involved in the rebellion of 1848–49 and fled the country when the revolt was put down; see GERMANY: *History*; REVOLUTIONS OF 1848. Schurz emigrated to the United States in 1852. Within five years after his arrival he attained a mastery of the English language that made him one of the most prominent public speakers of his time. In 1859 he was admitted to the bar in Milwaukee, Wis. Schurz became an active partisan of the antislavery movement and the Republican Party, and in 1860 he campaigned for the election to the U.S. Presidency of his close friend, Abraham Lincoln (q.v.). From 1861 to 1862 Schurz served as U.S. minister to Spain. In 1862, a year after the beginning of the

American Civil War (see CIVIL WAR, THE AMERICAN), he was appointed a brigadier general of volunteers in the Union Army and was later promoted to major general. At the conclusion of the war, in 1865, he turned to journalism, writing for, among other newspapers, the *New York Tribune*. He expressed his support of fair treatment of the South and also sought humane treatment of American Indians.

Schurz was elected to the United States Senate by the Missouri legislature in 1869, serving until 1875. Two years later he was appointed secretary of the interior by President Rutherford Birchard Hayes (q.v.), and held that post until 1881. In the latter year he moved to New York City, where, with the American journalists Edwin Lawrence Godkind (1831–1902) and Horace White (1834–1916), he founded the *New York Evening Post*. From 1892 to 1898 Schurz wrote the editorials for *Harper's Weekly*. He became nationally famous as a political writer and reformer, especially in the field of civil-service administration. His name is commemorated by the National Carl Schurz Association, formerly the Carl Schurz Memorial Society, and by Carl Schurz Park in New York City. In addition to many volumes of his collected speeches, books written by Schurz include *Life of Henry Clay* (2 vol., 1887) and *Abraham Lincoln: An Essay* (1891).

SCHUSCHNIGG, Kurt von. See AUSTRIA: *History: Anschluss*.

SCHUYLER, Philip John (1733–1804), American soldier and statesman, born in Albany, N.Y. One of the wealthiest men in the province of New York, he served with distinction in the French and Indian War (q.v.), and in 1768 he was made a member of the Colonial Assembly. In 1775, at the outbreak of the American Revolution (q.v.), Schuyler was elected a delegate to the Continental Congress (q.v.), which appointed him a major general in the Continental Army. General George Washington (q.v.) placed him in command of the Northern Department of New York. Schuyler was preparing the Canadian campaign of 1775–76 when ill health compelled him to turn over the field command of that expedition to the British-born American general Richard Montgomery (q.v.), but he continued to fight in New York. In July, 1777, Schuyler was blamed for the British capture of Fort Mifflin (q.v.) and in August he was replaced in command by the American general Horatio Gates (q.v.). Schuyler requested a court martial at which he was acquitted with honor, but in 1779 he resigned from the army. He remained one of Washington's close friends.

Schuyler was a member of the New York State senate for nineteen years between 1780 and 1797, and served in the United States Senate from 1794 to 1797 and in 1797-98. He also served as commissioner of Indian affairs and negotiated several treaties with the Six Nations (see IROQUOIS). Schuyler was the father-in-law of the American statesman Alexander Hamilton (q.v.). **SCHUYLKILL**, river of Pennsylvania. It rises in the coal-mining region of Schuylkill Co., near Pottsville, and flows 130 miles S.E. past Reading and Norristown, to its junction with the Delaware R. at the S. limit of Philadelphia. A series of dams and locks enable coal barges to ascend the Schuylkill R. as far as Port Clinton, 98 mi. upstream.

SCHWAB, Charles M(ichael) (1862-1939), American industrialist, born in Williamsburg, Pa., and educated at Saint Francis College in Loretto, Pa., from which he was graduated at the age of sixteen. In 1881 he was employed as an engineer's assistant in a subsidiary of the Carnegie Steel Company, Ltd., and by 1892 he had risen to the position of general superintendent of the Homestead (Pa.) works. He became president of the Carnegie Steel Company in 1897 and in 1901 played a major role in its merger with the United States Steel Corporation, a transaction of national financial importance. He served as president of the enlarged U.S. Steel Corporation from 1901 until 1903 and of the Bethlehem Steel Corporation from 1905 to 1916. He was also chairman of the board of directors of Bethlehem Steel from 1905 until his death.

SCHWANN, Theodor (1810-82), German physiologist and histologist, born in Neuss, and educated at the universities of Bonn, Würzburg, and Berlin. From 1838 to 1848 he was professor of anatomy at the University of Louvain in Belgium; thereafter until his death he was associated with the University of Liège, also in Belgium, serving as professor of anatomy from 1848 to 1858, when he became professor of physiology. Schwann is generally considered to be the founder of modern histology (q.v.), the study of the structure of plant and animal tissues. He ascertained the physiochemical nature of life by applying the cell theory of the German botanist Matthias Jakob Schleiden (q.v.) to the evolution of animal life; see EMBRYOLOGY. He also demonstrated that the mature tissues of all animals are traceable to embryonic, nucleated cells; see CELL. While assisting the German physiologist Johannes Peter Müller (1801-58) in the Anatomical Museum of Berlin, Schwann discovered pepsin, the digestive enzyme, in the stomach epithelium, or membrane tissues, of animals; see EN-

ZYMES. He also conducted valuable research on the processes of fermentation, putrefaction, and muscular and arterial contraction. His principal work is *Microscopic Investigations on the Accordance in the Structure and Growth of Plants and Animals* (1839; Eng. trans., 1847).

SCHWARZBURG-SONDERHAUSEN, former duchy of Germany. See THURINGIA.

SCHWARZKOPF, Elisabeth. See SOPRANO.

SCHWARZWALD. See BLACK FOREST.

SCHWEINFURT, city of West Germany, in Bavaria State, on the Main R., 28 miles N.E. of Würzburg. The city is a major center for the production of ball bearings. Other manufactures include paint dyes, particularly the well-known Schweinfurt green, machine tools, chemicals, and beer. The city has important cattle, sheep, and swine markets. The first historical reference to Schweinfurt was in 791, and the city was granted its civic charter in the 13th century. Pop. (1970) 58,200.

SCHWEITZER, Albert (1875-1965), French Protestant clergyman, philosopher, musicologist, organist, and medical missionary, born in Kayersberg, Upper Alsace, Germany (now Haut-Rhin Department, France), and educated at the universities of Strasbourg, Paris, and Berlin. He was ordained as the curate of the Church of Saint Nicholas in Strasbourg in 1900, and a year later he became principal of the theological seminary there. In music he soon gained fame as an organist and authority on organ construction. His best-known musicological work, *Johann Sebastian Bach*, was published in French in 1905 and rewritten in German in 1908 (Eng. trans., 1911). It emphasizes the deeply religious nature of the music of the German composer Johann Sebastian Bach (see *under* BACH) and advocates the simple, undistorted style of performing Bach's works that was accepted afterward as the standard type of presentation.

Religious Writings. Schweitzer's study *Von Reimarus zu Wrede: eine Geschichte der Leben-Jesu-Forschung* (1906; Eng. trans., *The Quest of the Historical Jesus*, 1910), which established his reputation as a theologian, interprets the life of Jesus in the light of his eschatological beliefs; see ESCHATOLOGY. In such other theological studies as *Die Mystik des Apostels Paulus* (1930; Eng. trans., *The Mysticism of Paul the Apostle*, 1931), Schweitzer examines the New Testament from the eschatological viewpoint of its reputed authors.

Medicine and Philosophy. From 1905 to 1913 Schweitzer studied medicine and surgery at the University of Strasbourg. He went to Lambaréne, French Equatorial Africa (now in Gabon),



Albert Schweitzer caring for an African child at his hospital in Lambaréné, Gabon. UPI

in 1913 as a medical missionary and set up a hospital; there he cared for some 2000 patients during his first year of work. In 1917–18 Schweitzer, as a German national, was interned in France. He wrote during that period two volumes of a projected philosophical study of civilization, namely *Verfall und Wiederaufbau der Kultur* (1923; Eng. trans., *The Decay and the Restoration of Civilization*, 1923) and *Kultur und Ethik* (1923; Eng. trans., *Civilization and Ethics*, 1923). Concerned in these volumes with ethical thought in world history, Schweitzer contends that modern civilization is in decay because it lacks the will to love. He suggests that man should develop a philosophy based on what he terms “reverence for life”, or the inspiration to love and embrace with compassion all forms of life.

Schweitzer remained in Europe until 1924, when he returned to Africa. In spite of floods, pestilence, and the lack of trained assistants, he built a hospital equipped to provide care for thousands of natives, including 300 lepers. He returned frequently thereafter to Europe to lecture and give organ recitals; in 1949 he visited the United States. He received the 1952 Nobel Peace Prize. His other works include the theological studies *Die Weltanschauung der indischen Denker: Mystik und Ethik* (1935; Eng. trans., *Indian Thought and Its Development*,

1936), *Reich Gottes und Christentum* (1967; Eng. trans., *The Kingdom of God and Primitive Christianity*, 1968), and the autobiographical *Aus meinem Leben und Denken* (1931; Eng. trans., *Out of My Life and Thought*, 1933).

Schweitzer was world renowned as a musician, ethical philosopher, and humanitarian. The variety of his interests was unified largely by the profound religious meaning he found in the natural world as well as in all of the accomplishments of man.

SCHWERIN, city in East Germany, and capital of Schwerin District, on Lake Schwerin, about 45 miles s.w. of Rostock. It is the marketing center of a dairy and agricultural region; the chief manufactures in the city are furniture, pharmaceuticals, soaps, and dyes. Noteworthy buildings include the Gothic cathedral, which was built mainly during the 14th and 15th centuries, and the former grand ducal palace, built in the mid-19th century. Schwerin, originally a Slavic settlement founded by the Wends (q.v.), is first mentioned in 1018. It received a municipal charter in 1166 from Henry the Lion (q.v.), Duke of Saxony. After 1358, the city was the capital of the Duchy of Mecklenburg, later Mecklenburg-Schwerin, and from 1934 to 1952 of Mecklenburg State. Pop. (1972 est.) 100,888.

SCHWINGER, Julian Seymour (1918–), American physicist, born in New York City. He received a B.A. degree from Columbia University at the age of seventeen and a Ph.D. three years later. After teaching and researching at various universities Schwinger, in 1945, joined the faculty of Harvard University. He shared the 1965 Nobel Prize in physics with two other physicists, the American Richard P. Feynman and the Japanese Shinichero Tomonaga (qq.v.). Schwinger, cited for his independent research in quantum electrodynamics, solved problems in making quantitative calculations of the interplay between electrons and positrons. See **ATOM AND ATOMIC THEORY**.

SCIATICA, common form of neuralgia or neuritis (qq.v.). It is an excruciating pain, occurring in sudden attacks, lasting for hours or days, caused by irritation or swelling of the sciatic nerve. The longest nerve in the human body, the sciatic nerve passes from the lower spinal column down the back of both thighs and legs. Initially, sciatica causes stiffness and swelling of the leg, that may affect the hip joint. In extreme cases, the hip and leg may be immobilized, sometimes followed by wasting of the calf muscles. Easily confused with rheumatism, sciatica may be caused by stretching, lifting, or standing; exposure to variations in climate; malnutrition

and lack of vitamins; debility and fatigue; tumors; and direct injury to the spine. Commonly, however, it originates in the pressure or stretching exerted on the sciatic nerve by a displaced intervertebral disc; see *SPINAL COLUMN: Abnormality and Disease*. It is treated by rest, corrective exercise, wearing braces, and sedation or local anesthesia. Less frequently, it is treated with varying success by surgery to correct defects of the spine or nerve.

See *LUMBAGO; SACROILIAC JOINT*.

SCIENCE (Lat. *scientia*, from *scire*, "to know"), term used in its broadest sense to denote systematized knowledge in any field, but applied usually to the organization of objectively verifiable sense experience. The pursuit of knowledge in this sense is known as "pure science" to distinguish it from "applied science", which searches for practical uses of scientific knowledge, and from technology through which applications are realized. See separate articles on most of the sciences mentioned in this article, and of all the scientists and scholars whose birth and death dates are not given.

Origins of Science. Primitive efforts to systematize knowledge can be traced to prehistoric times through the designs which paleolithic man painted on the walls of caves, through numerical records which he carved in bone or stone, and through artifacts surviving from neolithic civilizations; see *ANTHROPOLOGY; ARCHEOLOGY*. The oldest written records of protoscientific investigations come from Mesopotamian cultures where lists of astronomical observations, of chemical substances, and of disease symptoms, as well as a variety of mathematical tables, were inscribed in cuneiform characters on clay tablets; see *CUNEIFORM; MESOPOTAMIA; SUMER*. Other tablets from about 2000 B.C. show that the Babylonians knew the Pythagorean theorem, solved quadratic equations, and developed a sexagesimal system of measurement (based on the number 60) from which our time and angle units stem; see *BABYLONIA*. From the Nile Valley of almost the same period, papyri documents have been discovered containing instructions on the treatment of wounds and diseases, the distribution of bread and beer, and finding the volume of a frustum of a pyramid; see *EGYPT; EGYPTIAN ARCHEOLOGY; PALEOGRAPHY; PAPYRUS*. Some of the present-day units of length can be traced back to Egyptian prototypes; and the Gregorian calendar (q.v.) in common use today is the direct result of pre-Hellenic astronomical observations.

Rise of Scientific Theory. Scientific knowledge in Egypt and Mesopotamia was chiefly of a

practical nature, with little rational organization. Among the first Greek scholars to seek the fundamental causes of natural phenomena was the philosopher Thales, in the 6th century B.C., who held that the earth was a flat disc floating on the universal element, water. The mathematician and philosopher Pythagoras, who followed him, established a brotherhood in which mathematics became a discipline fundamental to all scientific investigation. The Pythagorean scholars postulated a spherical earth moving in a circular orbit about a central fire. At Athens in the 4th century B.C., Ionian natural philosophy and Pythagorean mathematical science combined to produce the syntheses of the philosophy of Plato and Aristotle; see *IONIA*. At the Academy of Plato deductive reasoning and mathematical representation were emphasized; at the Lyceum of Aristotle inductive reasoning and qualitative description were stressed. It is the interplay between these two approaches to science which has led to most subsequent advances; see *LOGIC*. During the so-called Hellenistic Age following the death of Alexander III (the Great), the mathematician, astronomer, and geographer Eratosthenes made a remarkably accurate measurement of the earth. Also, the astronomer Aristarchus of Samos espoused a heliocentric planetary system; the mathematician and inventor Archimedes laid the foundations of mechanics and hydrostatics; the philosopher and scientist Theophrastus became the founder of botany; the astronomer Hipparchus developed trigonometry; and the anatomists and physicians Herophilus and Erasistratus based anatomy and physiology upon dissection.

Following the destruction by the Romans of Carthage and Corinth (qq.v.) in 146 B.C., scientific inquiry lost its impetus until there was a brief revival under the Roman emperor and philosopher Marcus Aurelius in the 2nd century A.D. At this time the Ptolemaic system (q.v.) advanced by the astronomer Ptolemy, and the medical works of the physician and philosopher Galen became standard scientific treatises for the ensuing age. A century later the new experimental science of alchemy arose, springing from the practice of metallurgy. By 300 A.D., however, alchemy had acquired an overlay of secrecy and symbolism which vitiated the advantages that experimentation might have brought to science. **Medieval and Renaissance Science.** During the Middle Ages (q.v.), six leading culture groups were in existence: the Latin West, the Greek East, the Chinese, the East Indian, the Arabic, and the Mayan. The Latin group contributed little to science before the 13th century,

The Greek never rose above paraphrases of ancient learning, and the Mayan had no influence upon the growth of science. In China science enjoyed periods of progress, but no sustained drive existed. Chinese mathematics reached its high point in the 13th century with the solution of the equation (q.v.) by matrices and with the use of the arithmetic triangle. More important, however, was the impact upon Europe of several practical Chinese inventions. These include the manufacture of paper and gunpowder, and the use of printing and the mariner's compass. In India the chief contributions to science were the formulation of the so-called Hindu-Arabic numerals which are in use today, and in the conversion of trigonometry to a quasi-modern form. These advances were transmitted first to the Arabs, who combined the best elements from Babylonian, Greek, Chinese, and Hindu sources. By the 9th century, Baghdad (q.v.) on the Tigris R., had become a center for the translation of scientific works, and in the 12th century this learning was transmitted to Europe along routes in Spain, Sicily, and Byzantium.

Recovery of ancient scientific works at European universities led in the 13th century to controversy on scientific methods, with the realists espousing the Platonic approach, and the nominalists preferring the views of Aristotle; see NOMINALISM; REALISM; SCHOLASTICISM. At the universities of Oxford and Paris such discussions led to advances in optics and kinematics which paved the way for the German astronomer Johannes Kepler and the Italian astronomer and physicist Galileo Galilei. The Black Death (see PLAGUE) and the Hundred Years' War (q.v.) disrupted scientific progress for more than a century, but by the 16th century a revival was well under way. In 1543 the Polish astronomer Nicolaus Copernicus' *De Revolutionibus Orbium Coelestium* ("On the Revolutions of the Heavenly Bodies") was published, which revolutionized astronomy. The *De Corporis Humani Fabrica* ("On the Structure of the Human Body") of the Belgian anatomist Andreas Vesalius, also published in 1543, corrected and modernized the anatomical teachings of Galen and led to the discovery of the circulation of the blood (q.v.). Two years later the *Ars Magna* ("Great Art") of the Italian mathematician, physician, and astrologer Geronimo Cardano (1501–76) initiated the modern period in algebra with the solution of cubic and quartic equations. See RENAISSANCE.

Modern Science. Essentially modern scientific methods and results appeared in the 17th century through Galileo's successful combination

of the functions of the scholar and artisan. To the ancient methods of induction and deduction, Galileo added systematic verification through planned experiments, using newly discovered scientific instruments such as the telescope, the microscope, and the thermometer (qq.v.). Later in the century, the use of the barometer (q.v.) by the Italian mathematician and physicist Evangelista Torricelli, the pendulum clock (see CLOCKS AND WATCHES) by the Dutch mathematician, physicist, and astronomer Christian Huygens, and the exhaust pump by the English physicist and chemist Robert Boyle, and the German physicist Otto von Guericke made it "the century of genius." The culmination of these efforts was the universal law of gravitation (q.v.), published by the English mathematician, physicist, and astronomer Isaac Newton in *Philosophiae Naturalis Principia Mathematica* (Mathematical Principles of Natural Philosophy). At the same time the invention of calculus (q.v.) by Newton and the German philosopher and mathematician Baron Gottfried Wilhelm von Leibniz laid the foundation of today's sophisticated level of science and mathematics.

The scientific discoveries of Newton and the philosophical system of the French mathematician and philosopher René Descartes provided the background for the 18th century, known as the "century of materialism", in which life processes were explained on a physicochemical basis. Confidence in the scientific attitude carried over to the social sciences and inspired the so-called Age of Enlightenment, which culminated in the French Revolution (q.v.) of 1789; see ENLIGHTENMENT, AGE OF. The French chemist Antoine Laurent Lavoisier published *Traité Élémentaire de Chimie* (1789; Eng. trans., *Elements of Chemistry*, 1790), with which the revolution in quantitative chemistry opened.

Scientific developments during the 18th century paved the way for the following "century of correlation" with its broad generalizations, such as the atomic theory of matter postulated by the British chemist and physicist John Dalton, the electromagnetic theories of Michael Faraday and James Clerk Maxwell also of Great Britain, and the law of the conservation of energy enunciated by the British physicist James Prescott Joule, and others; see ATOM AND ATOMIC THEORY; ELECTROMAGNETIC RADIATIONS; ENERGY. Most comprehensive of the biological theories was that of evolution (q.v.), put forward by the British naturalist Charles Robert Darwin in his *Origin of Species by Means of Natural Selection* (1859), which stirred as much controversy as the work of Copernicus.



The Boeing Company-NASA

Science. Plate 1. An example of spin-off in modern science. This photograph of the Indian subcontinent from a Gemini spacecraft demonstrates that one stationary broadcast-relay satellite can be equipped to beam television programs over a vast area. Educational programs on health, family planning, improved agricultural techniques, and diverse other subjects as well as news events have been brought to millions of people living in thousands of remote Indian villages. Other practical benefits of space science are earth satellites to monitor weather, food crops, and pollution drift.

5; the beginning of the 20th century the fact, but not the mechanism, of evolution was generally accepted, with disagreement centering on the genetic processes through which it takes place. Meanwhile, as biology became more firmly based, physics was shaken by the unexpected consequences of quantum theory and the theory of relativity (q.v.). In 1927 the German physicist Werner Heisenberg formulated the so-called uncertainty principle (q.v.), which held that limits existed on the extent to which, on the subatomic scale, coordinates of an individual event can be determined. In other words, it was impossible to predict with precision that a particle, such as an electron, would be in a certain place at a certain time, moving at a certain velocity. See QUANTUM MECHANICS. This principle resulted in an increasing dependence on statistical inferences relating to large numbers of individual events; see STATISTICS.

Scientific Method. In science no one path to discovery exists. Descartes derived his results deductively from what he thought were clear and distinct ideas. The 16th-century English philosopher and statesman Francis Bacon, avoiding such hypotheses, believed that a tabulation of a sufficiently large number of instances would explain the operations of nature. A closer approach to the method commonly adopted by physical scientists today is that practiced by Galileo in his study of falling bodies. Observing that heavy objects fall with increasing speed, he formulated a hypothesis—that the speed acquired is directly proportional to the distance traversed. Being unable to test this directly, he deduced from this hypothesis the conclusion that objects falling unequal distances require the same elapsed time. In valid reasoning a false conclusion implies that the premise is false; and hence Galileo framed a new hypothesis—that the speed acquired is directly proportional to the time elapsed. From this he was able to infer that the distance covered by a falling object is proportional to the square of the time elapsed; and this he was able to verify experimentally by rolling balls down an inclined plane. One must keep in mind, however, that agreement of a conclusion with experience does not itself prove the correctness of the hypothesis from which it is derived; it simply renders the premise so much the more plausible. The ultimate test of the validity of a scientific law or hypothesis is its consistency with the totality of other aspects of the scientific framework through which man attempts to “explain” nature. It is this inner consistency which constitutes the basis for the concept of causality in science, according to which

every effect is assumed to be linked with a cause.

Quantitative description and deductive reasoning in the past were not easily applied to geology and the life sciences, where greater weight had been placed on qualitative classifications of specific observations. In the 18th century the Swedish botanist Carolus Linnaeus greatly expanded the botanical ordering of plant species, and at the same time fossil specimens were correlated with descriptive stratigraphy. It was from such work that theories concerning the origin and age of man developed. Even with the advent of evolutionary views, however, methodology in the life sciences remained predominantly qualitative. With studies in genetics initiated by the Austrian priest and botanist Gregor Johann Mendel, and pursued by biologists in the 20th century, biology has become increasingly quantitative. The life sciences today have joined the physical sciences in the increasingly frequent recourse to statistical formulations of scientific laws. See The Sciences, *below*.

Scientific Communication. Throughout history, scientific knowledge has been transmitted chiefly through written documents, some of which are over 4000 years old. From ancient Greece, however, no substantial scientific work survives from the period before the geometriician Euclid's *Elements* (about 300 B.C.). Of the treatises written by leading scientists after that time, only about half have survived. Some of these are in Greek and others were preserved through translation by Arab scholars in the Middle Ages. Medieval schools and universities were largely responsible for preserving these works and also for fostering scientific activity. Since the Renaissance, however, this work has been shared by scientific societies, the oldest of which still surviving is the Accademia del Lincei (to which Galileo belonged), established in 1603 to promote the study of mathematical, physical, and natural sciences. Later in the century governmental support of science led to the founding of the Royal Society of London (1662) and the Académie des Sciences de Paris (1666). These two organizations initiated publication of scientific journals, the former under the title *Philosophical Transactions*, and the latter as *Mémoires*. During the 18th century academies of science were established by other leading nations. In the United States a club organized in 1727 by the scientist, statesman, and philosopher Benjamin Franklin became the American Philosophical Society in 1769 for “promoting useful knowledge”, and in 1780 the American Academy of Arts and Sciences was organized by

SCIENCE

John Adams, who was to become the second President of the United States in 1796. In 1831 the British Association for the Advancement of Science met for the first time, followed in 1848 by the American Association for the Advancement of Science, and in 1872 by the Association Française pour l'Avancement des Sciences. These national organizations issue the journals *Nature*, *Science*, and *Compte-rendus* respectively. The number of scientific journals grew so rapidly during the early 20th century that *A World List of Scientific Periodicals Published in the Years 1900-1933* contained some 36,000 entries in 18 languages. A large number of these are issued by specialized societies devoted to individual sciences, and most of them are less than 100 years old.

Since late in the 19th century communication among scientists has been facilitated by the establishment of international organizations, such as the International Bureau of Weights and Measures (1873) and the International Council of Research (1919). The latter is a scientific federation subdivided into international unions for each of the various sciences which hold international congresses every few years, and the transactions of which are usually published. In addition to national and international scientific organizations, numerous research departments of major industrial firms are in existence, and some of them regularly publish accounts of the work done or file reports with government patent offices, which in turn print abstracts in periodical bulletins.

The Sciences. Knowledge of nature originally was largely an undifferentiated observation and interrelation of experiences. The Pythagorean scholars distinguished only four sciences, arithmetic, geometry, music, and astronomy, and by the time of Aristotle, one could recognize in addition, mechanics, optics, physics, meteorology, zoology, and botany. Chemistry remained outside the mainstream of science until the time of Boyle in the 17th century, and geology achieved the status of a science in the 18th century, when the study of heat, magnetism, and electricity became parts of physics. During the 19th century it was finally recognized that pure mathematics differed from the other sciences in that it was a logic of relations and did not depend for its structure on the laws of nature; yet its applicability in the elaboration of scientific theories has resulted in its continued classification among the sciences. The pure natural sciences are generally divided into two classes, the physical sciences and the biological or life sciences. Principal branches among the former are physics,

astronomy, chemistry, and geology; and the chief biological sciences are botany and zoology. Each of the above sciences can be subdivided to identify such fields as mechanics, cosmology, physical chemistry, and meteorology, or, among the biological sciences, physiology, embryology, anatomy, genetics, and ecology.

All classifications of the pure sciences, however, are arbitrary. In the formulations of general scientific laws, interlocking relationships among the sciences are recognized; they are considered responsible for much of the progress today in several specialized fields of research, such as molecular biology and genetics. Several interdisciplinary sciences, such as biochemistry, biophysics, biomathematics, and bioengineering, have arisen, in which life processes are explained physicochemically. Biochemists, for example, synthesized deoxyribonucleic acid (DNA); and the cooperation of biologists with physicists led to the invention of the electron microscope (q.v.), through which viruses and gene mutations can be studied; see HEREDITY; NUCLEIC ACIDS. The application of these interdisciplinary methods is also expected to produce significant advances in the fields of social and behavioral sciences; see BEHAVIORAL SCIENCES; PSYCHIATRY; PSYCHOANALYSIS; PSYCHOLOGY; PSYCHOLOGY, EXPERIMENTAL; PSYCHOSOMATIC MEDICINE; PSYCHOTHERAPY.

Applied sciences can be classified into aeronautics, electronics, engineering, and metallurgy, which are applied physical sciences; agronomy and medicine are applied biological sciences. In this case also, one must recognize overlapping branches. The cooperation, for example, between iatrophysics, which is a branch of medical research based on principles of physics, and bioengineering resulted in the development of the heart lung machine used in open-heart surgery, and also in the design of artificial organs such as heart chambers and valves, kidneys, blood vessels, and inner-ear bones. Advances such as these are generally the result of research by teams of specialists representing different sciences, both pure and applied. This interrelationship between theory and practice is as important to the growth of science today as it was at the time of Galileo.

C.B.B.

SCIENCE FICTION, the fictional treatment in print, motion pictures, television, or other mediums of the effects of science or future events on human beings. More precisely, science fiction deals with events that did not happen or have not yet happened; it considers these events rationally in terms both of explanation and of consequences; and it is concerned with the im-

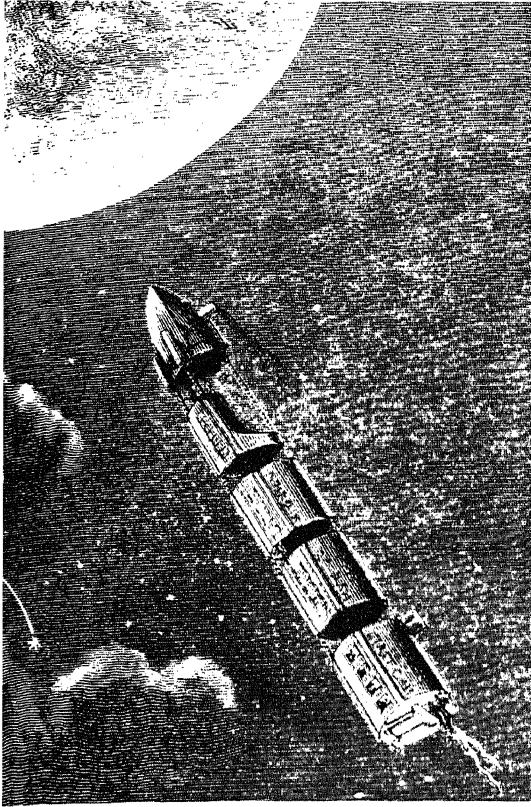


Illustration for *A Trip to the Moon* by Jules Verne.
Bettmann Archive

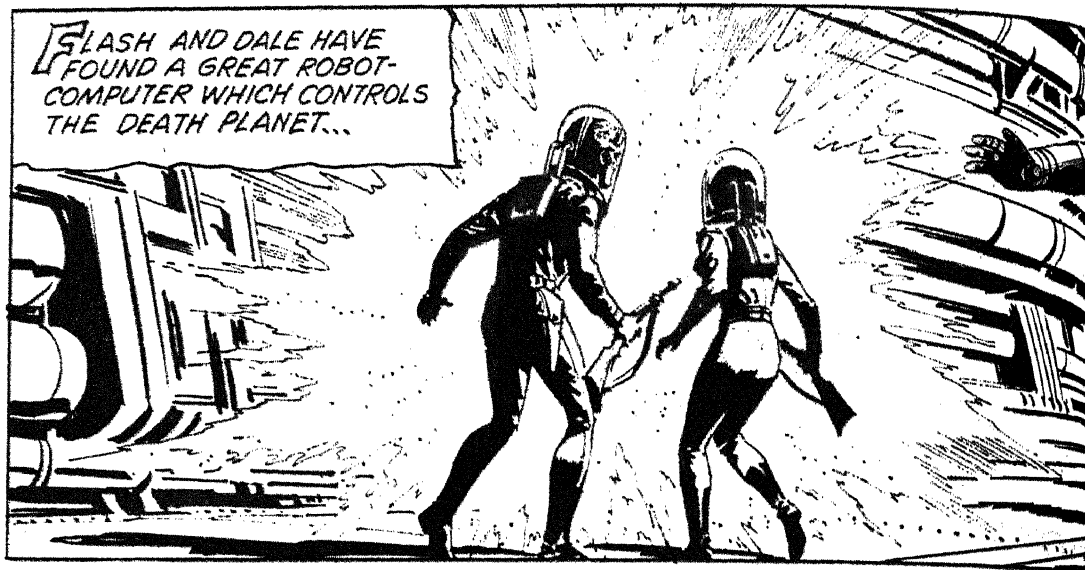
pact of change on people, often with its consequences for the human race. The most common subjects for science fiction are the future, travel through space or time, life on other planets, and crises created by technology or alien creatures and environments.

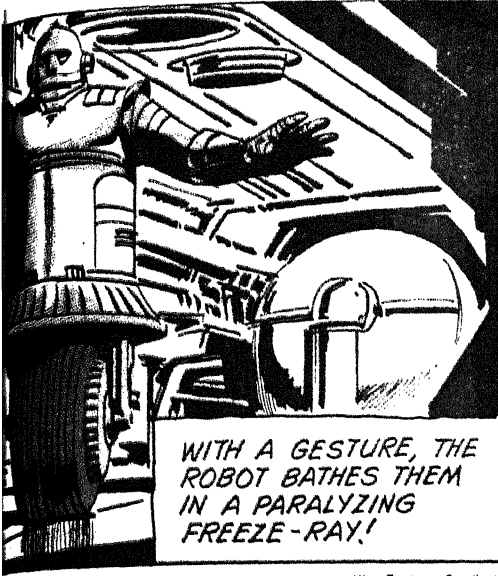
Progenitors. The subjects of science fiction have been touched upon by fantastic literature since ancient times. The Babylonian *Epic of Gilgamesh* dealt with a search for ultimate knowledge and immortality, the myths of Daedalus with the technology of robots and flying, and the *True History* (about 160 A.D.) of Lucian of Samosata with a trip to the moon. Imaginary voyages and tales of strange people in distant lands were common in Greek and Roman literature, and found new expression in the 14th-century book of travels written in French by the pseudonymous Sir John Mandeville. Trips to the moon were described by figures as diverse as Cyrano de Bergerac, William Godwin, and Johannes Kepler, among others. Another subject, the structure of better societies or better worlds, which goes back at least to the 4th century B.C. with Plato's *The Republic*, was reintroduced and given a generic name when Thomas More wrote *Utopia* (1516). Stories of an imaginary voyage

usually were written for satirical purposes; perhaps the finest example is *Gulliver's Travels* (1726) by Jonathan Swift. But science fiction could not exist in its present form until the fact of social change was recognized after the beginning of the industrial revolution (about 1750). The Gothic novel of the 18th century culminated in Mary Wollstonecraft Shelley's *Frankenstein* (1818), a work transformed by a belief in the potential of science. Many authors of the 19th century, such as Edward Bellamy, Nathaniel Hawthorne, Rudyard Kipling, Fitz-James O'Brien (about 1828-62), Edgar Allan Poe, and Mark Twain, worked with the new fiction at one time or another. The first great specialist of science fiction, however, was the French author Jules Verne, who dealt with geology and cave exploration in *Journey to the Center of the Earth* (1864), space travel in *A Trip to the Moon* (1865) and *Off on a Comet* (1877), and the submarine and underwater marvels in *20,000 Leagues Under the Sea* (1870).

Science-Fiction Novels in English. Stories of lost races and unexplored corners of the world were popular in Victorian England: H. Rider Haggard's *She* and *Allan Quatermain* appeared the same year, 1887, and in 1912 Sir Arthur Conan Doyle's *The Lost World* was published. But the first major writer of science fiction in English and the man who may be considered the father of modern science fiction is H. G. Wells. More interested in biology and evolution than in the physical sciences and more concerned about the social consequences of invention than the accuracy of the invention itself, Wells from 1894 wrote stories of science invested with irony and realistic conviction. His reputation grew rapidly after the publication of *The Time Machine* in 1895; this was followed by *The Island of Dr. Moreau* (1896), *The Invisible Man* (1897), *The War of the Worlds* (1898), *When the Sleeper Wakes* (1899), and *The First Men in the Moon* (1901), before Wells turned to other forms of literature.

Other science-fiction novels appeared from British writers during the first half of the 20th century. Particularly noteworthy are the extravagant fancies of Matthew Phipps Shiel (1865-1947; *The Purple Cloud*, 1901), the cosmic panoramas of Olaf Stapledon (1886-1950; *Last and First Men*, 1930), and the studies in interplanetary theology by the theologian and philosopher C. S. Lewis (*Out of the Silent Planet*, 1938). In addition, many British authors of standard fiction wrote one or two striking novels of a socially prophetic nature. Particularly successful and influential were *Brave New World* (1932), by Aldous Huxley, and *1984* (1949), by



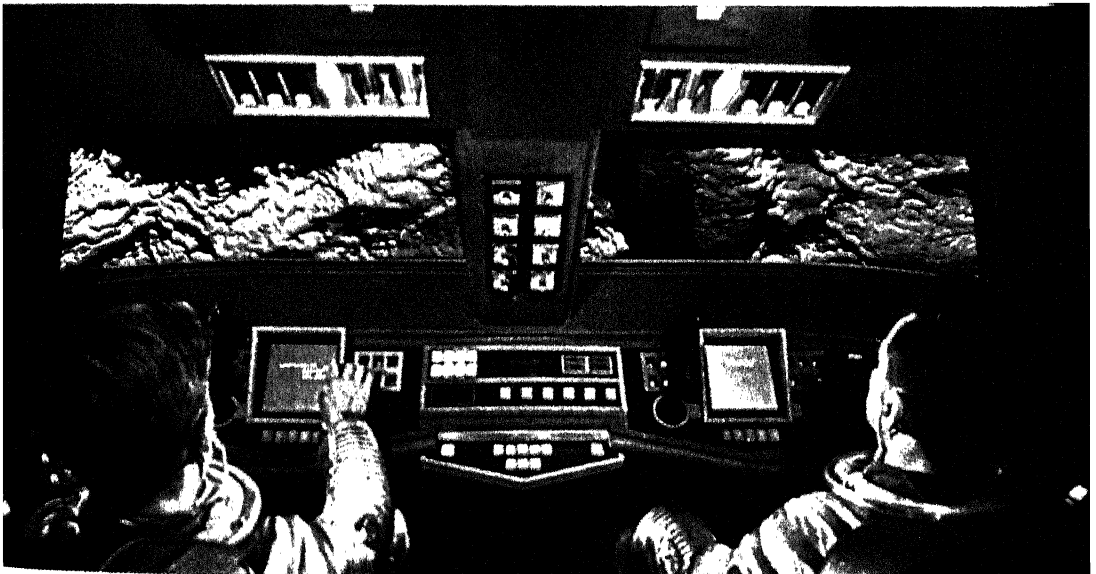


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Science Fiction. Plates 1 and 2. The fictional treatment of alien environments and phenomena, created or unleashed by modern science, has been effective in print, on television, and in motion pictures. The adventures of the futuristic hero Flash Gordon (above) have been depicted in comic strips and on television; and Captain Marvel (left), the superhuman comic-strip trouble-shooter, is a source of excitement and entertainment for many young minds. Right: In *A Clockwork Orange*, the American filmmaker Stanley Kubrick depicts the failure of sophisticated psychological and chemical treatment to cure the principal character of his predilection for excessively violent behavior. Below: In *2001: A Space Odyssey*, in a world where space travel is commonplace, Kubrick attempts to chart the inexorable progress of science and the probable confrontation of man, machine, and the interplanetary environment.



From the motion picture "CLOCKWORK ORANGE" by Warner Bros. Inc. © 1971



"2001: A SPACE ODYSSEY" © 1968-Metro-Goldwyn-Mayer Inc.

SCIENCE FICTION

George Orwell. One of the most prolific writers of works dealing with both science fiction and science fact is Arthur C. Clarke (1917– ; *Childhood's End*, 1953).

In the opinion of many critics one of the most able American writers of mainstream science fiction, combining scientific extrapolation with narrative art, is Robert Heinlein (1907– ; *The Man Who Sold the Moon*, 1950, and *Stranger in a Strange Land*, 1961). Other widely known American science-fiction authors are Isaac Asimov (1920– ; *The Caves of Steel*, 1953), who also is a prolific author of popular science books, and Ray Bradbury (1920– ; *The Martian Chronicles*, 1950), who is considered more of a fantasy writer.

The publication of science fiction in book form in the United States was infrequent between 1926 and 1946. Today it is an accepted category of publishing, with book publication of novels, short-story collections, and anthologies making up approximately 10 percent of the total works of fiction published annually.

Science-Fiction Magazines. The characteristically American type of science fiction was at first published almost entirely in magazines. The authors of magazine science fiction emphasized technical accuracy and plausibility above literary value and sometimes above characterization. The mass magazines that developed in the last decade of the 19th century published many stories of science, and the pulp fiction magazines that followed *Argosy*, founded in 1896, included many stories of romance and wild adventure such as those written by Edgar Rice Burroughs and Garrett P. Serviss (1851–1929). But the unspecialized fiction magazines evolved into the category pulps, and in 1926 Hugo Gernsback (1884–1967), a Luxembourg immigrant who became a well-to-do American editor, publisher, inventor, and author, founded the first science-fiction magazine, *Amazing Stories*. He believed that fiction could be a medium for disseminating scientific information and creating scientists, and he published and also wrote stories with this in mind. An example of his own writing is *Ralph 124C41+*, first serialized in his popular science magazine *Modern Electrics* in 1911. Gernsback also created a name for the new form, “scientifiction”, which he changed in 1929, with the founding of *Science Wonder Stories*, to “science fiction”. In 1937, when John Wood Campbell, Jr. (1910–71), became editor of *Astounding Stories*, that magazine began to feature a new type of science fiction. As an author, especially in the works he wrote under the pen name Don A. Stuart, Campbell already had

added mood and characterization to the technical and prophetic aspect of science fiction. As an editor, he encouraged other writers to produce science fiction of literary merit, and fostered what has since been called “the golden age” of science fiction.

Later magazines included *Fantasy and Science Fiction*, founded in 1949 by the American authors and editors Anthony Boucher (1911–68) and Jesse Francis McComas (1910–), and *Galaxy Science Fiction*, founded in 1950 by the American author and editor Horace Leonard Gold (1914–). In these magazines emphasis shifted more toward literary, psychological, and sociological preoccupations, with some loss of scientific content.

Beginning in the mid-1960's a new concern for humanistic values and experimental techniques emerged, calling itself “the new wave”; it entered science fiction primarily through the English magazine *New Worlds* and was typified by the British writers Brian Aldiss (1925–) and James Ballard (1930–) and the American writer Harlan Ellison (1934–). The new wave, preferring to call what it wrote “speculative fiction”, was most prominently published in anthologies of original work, in particular Ellison's anthologies beginning with *Dangerous Visions* (1967). **Motion Pictures.** Science fiction has interested filmmakers since the earliest days of the cinema (see MOTION PICTURES, HISTORY OF), though not often to the benefit of the film or of science fiction. Most such films have been based on science-fiction literature and comic strips; see COMIC STRIP.

Unlike the literature, science-fiction cinema has increasingly been preoccupied with unnatural creatures of various sorts, giving rise to a subgenre colloquially referred to as horror or monster movies. Motion pictures featuring alien beings, mutant creatures, or soulless humans have more often than not been stereotyped melodramas. Among common themes of science-fiction motion pictures are the fallibility of megalomaniacal scientists, the urgency of international cooperation against invaders from outer space or monsters from the earth, the rash hostility of people to anything alien, and the evil aspects of technology.

The earliest motion picture to treat fantasy, if not science fiction proper, was *Le Voyage dans la lune* (“A Trip to the Moon”), created by the French filmmaker and magician George Méliès (1861–1938) in 1902. Thomas A. Edison's motion-picture company produced *A Trip to Mars* in 1910. Early German filmmakers produced influential motion pictures culminating in such ex-

pressionistic films as Robert Wiene's *The Cabinet of Dr. Caligari* (1919) and Fritz Lang's *Metropolis* (1926). Prominent American monster films, which have since inspired countless sequels, are *Frankenstein* (1931), *Dracula* (1931), and *The Mummy* (1932). In 1933 came *King Kong* and *The Invisible Man*. In 1936 Great Britain produced the ambitious *Things To Come*, a visionary treatment of a utopian technocracy, the scenario for which was written by the author of the novel from which it was adapted, H. G. Wells. Notable American serials of the 1930's were based on the comic strip characters Flash Gordon and Buck Rogers.

The American producer and director George Pal (1908?-) was responsible for several well-regarded science-fiction films, beginning in 1950 with *Destination Moon* and continuing with *When Worlds Collide* (1951), *The War of the Worlds* (1953), and *The Time Machine* (1960). All four films won awards of the Academy of Motion Picture Arts and Sciences for their special effects. Other notable films of the 1950's were *The Day the Earth Stood Still* (1950), *Forbidden Planet* (1956), and *The Invasion of the Body Snatchers* (1956).

The critically acclaimed science-fiction films of the 1960's and 1970's include *The Day of the Triffids* (1963), *Alphaville* (1965), *Fahrenheit 451* (1966), *Fantastic Voyage* (1966), *Planet of the Apes* (1968), *The Forbin Project* (1970), *The Andromeda Strain* (1971), *The Man Who Fell to Earth* (1976), and the spectacular remake of *King Kong* (1976). The epic *2001: A Space Odyssey* (1968) became one of the most widely discussed science-fiction films of all time.

Radio and Television. One of the most successful science-fiction programs on radio in the 1930's was the serial "Buck Rogers". In 1938 the realism of a broadcast production of *The War of the Worlds* by the American actor and director Orson Welles aroused panic among some listeners. Later such programs as "Dimension X" and "X Minus One" dramatized science-fiction short stories.

Two American television programs from the 1950's were the science-fiction serials "Captain Video" and "Tom Corbett, Space Cadet". In later years, Superman and other comic book heroes were featured. More recent television programs popular with adults include "Twilight Zone", "Outer Limits", "Lost in Space", "Land of the Giants", "The Immortal", and "Star Trek". The last enjoyed such success in syndication after three years on the air that it created a surprising fan movement and attracted more than 10,000 followers to major conventions. Its success in-

spired two subsequent syndicated series, "The Starlost" and "Space 1999".

Conventions and Awards. Science-fiction fans began organizing World Science Fiction Conventions in 1939. In the 1950's fans attending the convention began awarding "Hugos", rocket-shaped trophies, for what they voted the best novels and stories of the year. The Science Fiction Writers of America, founded in 1965, annually award "Nebulas", spiral nebula shapes embedded in lucite, to the work chosen as best.

Science Fiction and Science. Two major events brought science fiction general recognition as a literature of relevance: the explosion of the first atomic bomb in 1945 and the successful landing on the moon on July 20, 1969, of two American astronauts. Atomic bombs (and atomic energy) and spaceflight had been two of the major subjects of science fiction almost from its beginnings, and had been ridiculed by traditional critics and even many scientists as "mere science fiction". Their realization and the recognition by many persons of the way in which life is being changed by science and technology have contributed to what Isaac Asimov has called "a science-fiction world". This awareness was intensified in July, 1976, when a space vehicle landed on Mars and transmitted the first on-site photographs of another planet ever to reach earth. Scientists and explorers have credited science-fiction works by Jules Verne and others for starting them on their life journeys. Space exploration by Soviet scientists was influenced by the writings of the Russian author Konstantin Eduardovich Tsiolkovsky (1857-1935; *Beyond Earth*, 1920), and German rocket research was inspired partly by the works of the German author Kurd Lasswitz (1848-1910; *On Two Planets*, 1897).

Science Fiction and the Classroom. The growing acceptability of popular culture throughout society, along with increasing consideration for the likes and dislikes of students, brought courses in science fiction into colleges and universities beginning in 1962. Today almost all colleges and universities in the U.S. have at least one course in science fiction, as do many secondary schools. Teachers and scholars in the field organized the Science Fiction Research Association in 1970. Two scholarly journals, *Extrapolation* and *Science Fiction Studies*, are published semiannually, along with countless amateur and semiprofessional fan magazines in the U.S. and abroad.

See also biographies for the authors mentioned above for whom life dates are not provided.

A.Bo. & L. del R.; J.G.

SCIENTIFIC METHOD

SCIENTIFIC METHOD. See **SCIENCE: Scientific Method.**

SCILLY ISLES or **SCILLY ISLANDS,** Great Britain, archipelago in the Atlantic Ocean, part of Cornwall, England, about 25 miles s.w. of Land's End. The group consists of about 140 small islands and rocks, with a total area of about 6 sq.mi. Only five of the islands are inhabited; they are Saint Mary's, Tresco, Saint Martin's, Saint Agnes, and Bryher. The Scilly Isles are noted for their rugged granite cliffs and wild scenery. The climate is consistently mild and the principal industry is the production of flowers and vegetables, which are grown during the winter and shipped to Bristol and London. Hugh Town, on St. Mary's, is the capital and has a substantial harbor and roadstead. The islands are administered by a council and are included in the Saint Ives parliamentary division of Cornwall.

SCINTILLATION COUNTER, instrument employed in nuclear research to detect, measure the energy of, and count nuclear particles. Like all radiation-detecting devices, the scintillation counter functions by virtue of the ionization (q.v.) produced by charged particles moving at high speed. The ionization, in the scintillation technique, takes place within certain transparent solids and liquids, known as scintillating materials, causing flashes of visible light. The rare gases argon, krypton, and xenon produce ultraviolet scintillations that can be converted into visible light. Therefore these gases have recently been used in scintillation counters. The phenomenon of scintillation, or fluorescence, was discovered in the 17th century; see **FLUORESCENCE** AND **PHOSPHORESCENCE**. A primitive scintillation device, known as the spintharoscope, which was invented in the early 1900's, was of considerable importance in the development of nuclear physics. The spintharoscope required, however, the counting of the scintillations by eye. Because of the uncertainties of this method, physicists initiated a search for more reliable techniques; they ultimately succeeded in constructing devices that would automatically record the ionizing effect of the particles. Among such devices were the cloud chamber (q.v.), bubble chamber, spark chamber, and various other ionization chambers, including the noted Geiger-Müller counter. The scintillation method was revived in 1947 by utilizing the photomultiplier tube, a type of photoelectric cell (q.v.), in conjunction with a recording device. See also **IONIZATION CHAMBER**.

Various organic and inorganic substances are used as scintillating materials. Certain sub-

stances react more favorably to specific types of radiation than others, making possible highly diversified instruments. The inorganic phosphors, such as zinc sulfide, are very sensitive to alpha particles. The most popular inorganic scintillator is sodium iodide, activated with a trace of thallium. It can be fabricated into very large crystals which are used to distinguish the energy of gamma rays. Anthracene and other organic phosphors are employed to detect beta and gamma radiation. Liquid scintillating materials have the advantage of flexibility in relation to size and shape. Plastic scintillators are also widely used, particularly in high-energy physics.

The scintillation counter is superior to all other radiation-detecting devices in a number of fields of current research. It has replaced the Geiger-Müller counter in the detection of biological tracers (q.v.) and as a surveying instrument in prospecting for radioactive ores. The instrument is also employed in nuclear research, notably in the investigation of such particles as the antiproton (see **PROTON**), the meson, and the neutrino (qq.v.). G.T.S.

SCINTILLOGRAM or **SCINTISCAN,** two-dimensional recording of gamma radiation from a radioisotope injected into the body, used to diagnose certain kidney diseases. See **ISOTOPE: KIDNEY; TRACERS**.

SCINTILLON, crystalline-like particle found in an aquatic flagellate (q.v.), *Gonyaulax polyedra*. It emits a flash of light and is believed responsible for the organism's luminescence. See **BIO-LUMINESCENCE**.

SCINTISCANNING, technique used in diagnosis of liver (q.v.) disease, which records the concentration of gamma rays emitted by a small amount of radioactive substance introduced into the body. See **ISOTOPE; TRACERS**.

SCIOTO, river of Ohio, rising in Hardin Co. It flows E. and then generally S., past Columbus and Chillicothe, to its junction at Portsmouth with the Ohio R. The Scioto is about 237 mi. long. The Olentangy R. is its chief tributary.

SCIPIO, name of a noble Roman family of military leaders, noted for their love of Greek culture. Among the more important members of the family are the following.

Publius Cornelius Scipio Africanus, known as **SCIPIO THE ELDER** (234?-183 B.C.), one of the most famous generals of ancient Rome and a hero of the Second Punic War (see **PUNIC WARS**) between Carthage and Rome. In 210 B.C., after serving in the Roman legions sent against the Carthaginian general Hannibal (q.v.) in northern Italy, Scipio was put in command of the Roman armies in Spain. Arriving there in 209 B.C., he led

a surprise attack against the headquarters of the Carthaginian army at Nova Carthago (now Cartagena), thereby depriving Carthage of its principal supply base. By 206 B.C. he had driven the Carthaginian general Hasdrubal (see *under* HASDRUBAL) from Spain, but had failed to prevent him from crossing the Pyrenees to assist his brother Hannibal. Scipio returned to Rome in triumph in 205 B.C. and was elected consul to Sicily. There he prepared for the invasion of Africa. Landing west of Carthage with his army in 204 B.C., Scipio defeated the combined forces of the Carthaginians and their allies. The Carthaginians would not accept Scipio's harsh peace terms, however, and they recalled Hannibal from Italy to defend the city. When the two armies met southwest of Carthage, near Zama, Scipio routed the Carthaginian forces, and the Second Punic War was concluded. For this conquest Scipio was granted the surname Africanus.

In 190 B.C. Scipio served as tactical advisor to his brother in the war with Antiochus III, King of Syria (see *under* ANTIOCHUS); the Syrian force was crushed in the great Roman victory at Magnesia in Asia Minor. On his return to Rome Scipio was accused by his enemy, the Roman statesman Marcus Porcius Cato (q.v.), of accepting bribes from the Syrian king. He was acquitted of the charges, but retired from public life to his villa at Liternum in Campania. Scipio Africanus is regarded as the greatest Roman general before Gaius Julius Caesar (q.v.). In addition to his military feats he was an accomplished scholar and encouraged appreciation of Greek culture in Rome.

Publius Cornelius Scipio Aemilianus Africanus Numantinus, known as **SCIPIO THE YOUNGER** (about 185–129 B.C.), general, the adopted grandson of Scipio the Elder. After serving in the Roman military campaigns in Macedonia, he became military tribune to Spain in 151 B.C. Following the outbreak of the Third Punic War, Scipio, as the favorite both of the Roman army and the Roman people, was elected consul in 147 B.C. and invested with supreme command. After a year of heavy fighting Scipio captured Carthage and destroyed it. He returned to Rome in triumph, having earned in his own right the surname Africanus he had inherited from his grandfather.

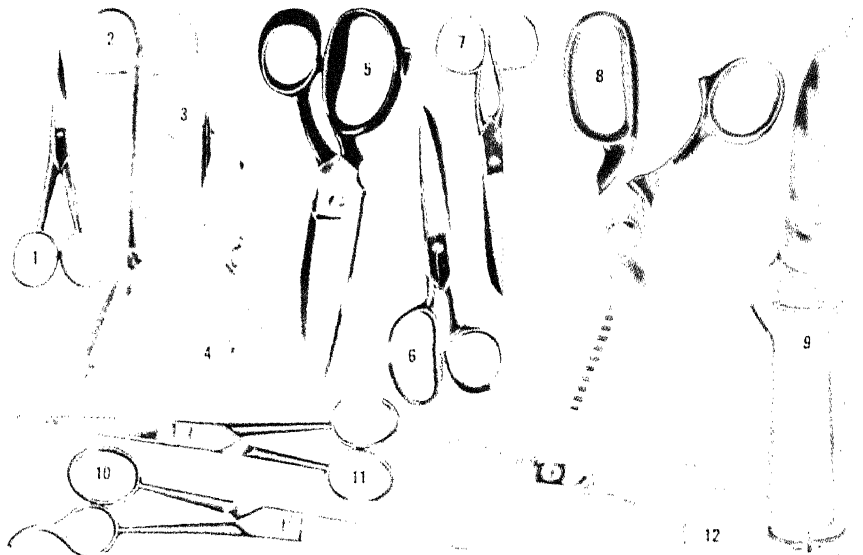
After serving as censor in Rome for several years, Scipio was again elected to the consulship in 134 B.C., and was sent to Spain to conduct the siege against Numantia. The capture and destruction of the town ended twenty years of warfare in Spain, and gave Scipio the additional surname Numantinus. On his return to Rome he became the leader of the aristocracy in their battle against the popular and agrarian reforms of his cousin Tiberius Sempronius Gracchus (see *under* GRACCHUS). On the night before Scipio was scheduled to deliver a speech on agrarian laws, he died, perhaps assassinated by his political enemies. Scipio was noted as a patron of Greek culture and of contemporary Roman writers.

SCISSORBILL. See **SKIMMER**.

SCISSORS, cutting instrument with two blades, the edges of which slide past each other. The blades are attached by a common fulcrum in the form of a screw or a pin and they operate

1. Surgical Scissors
2. Bandage Scissors
3. Professional Manicure Scissors
4. Baby Scissors
5. Tailor Bent Dressmaking Scissors
6. Straight Handle Dressmaking Scissors
7. Sewing Scissors
8. Pinking Dressmaking Scissors
9. Poultry Scissors
10. & 11. Barber Scissors
12. Thinning Scissors

American Cutlery & Hardware Co.



SCISSOR-TAILED FLYCATCHER

simultaneously by lever action when the handles are pushed together; see **LEVER**. Different types of scissors are designed for specific uses, but they are all based on the same lever principle. In addition to their household use, specially designed scissors are used in surgery, embroidery, and manicuring. The heavy-duty trimming scissors employed in gardening are known as shears, as are the instruments used by professional dressmakers and hairdressers.

SCISSOR-TAILED FLYCATCHER, beautiful flycatching bird, *Muscivora forficata*, of southwestern United States, remarkable for its long outer dark-tipped tail feathers, which in flight open and shut like a pair of scissors. The body is about 6 in. long, the tail about 9½ in. The general color is light pearly gray, the sides and wing linings pink, and the lower parts white, washed along the flanks with salmon pink.

SCLEROSIS, induration or hardening, resulting from degenerative changes in which normal tissues are replaced by connective tissue, as in a scar. Hardening of the middle coat of an artery is termed arteriosclerosis; see **ARTERY**: *Diseases of the Arteries*. Replacing of the normal tissue of the liver by connective tissue is termed cirrhosis of the liver; see **LIVER**: *Diseases of the Liver*. Degeneration and destruction of the tissue of the spinal cord or of the brain is termed sclerosis and is the essential lesion of several diseases, such as multiple sclerosis (q.v.).

SCONE, Great Britain, parish in Perth County, Scotland, consisting of the adjacent villages of Old Scone and New Scone, on the Tay R., 2 miles N.E. of Perth. The principal industry is agriculture. According to tradition, Old Scone became the capital of the kingdom of the Picts (q.v.) in the 8th century. An early Culdee monastery, which became an Augustinian abbey in the 12th century, contained the famous Stone of Scone, or Stone of Destiny, which was believed to have been brought there during the 8th century. The Scottish kings were crowned on the stone until 1296, when Edward I (q.v.), King of England, placed it permanently in Westminster Abbey, in London (see **CHAIR**: *Medieval*). The Scottish sovereigns continued to be crowned at Scone, although the 12th-century abbey in the parish was destroyed by Protestant zealots in 1559, and the last coronation to be held there was that of the future English king Charles II (q.v.), who was crowned king of Scotland in 1651, during his exile from England. The present Palace of Scone was built in 1803. Pop. (1971) 3565.

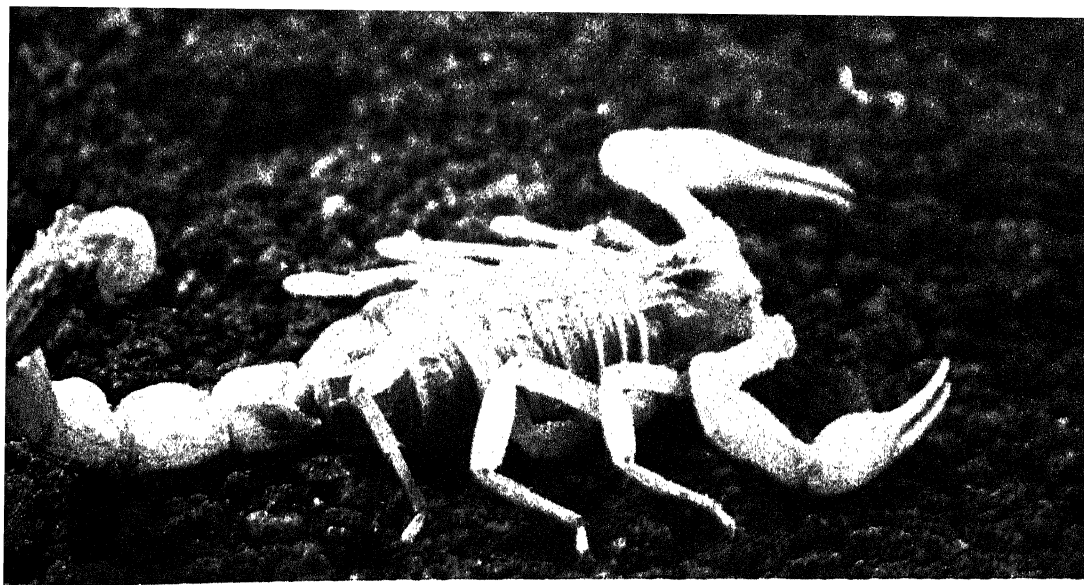
SCOPAS (fl. 4th cent. B.C.), Greek sculptor and architect, born on the island of Páros. Works at-

tributed to Scopas are characterized by an intensely expressive style, and he is considered to be a founder, with the Greek sculptor Praxiteles (q.v.), of the late Attic school; see **GREEK ART AND ARCHITECTURE**: *The Classical Period*. Among the few remaining original works identified with Scopas are the pediment sculptures (now in the National Museum, Athens) from the temple of Athena Alea, at Tegea, of which he may also have been the architect. Toward the end of his life Scopas is believed to have collaborated in preparing sculptures for the great Mausoleum (q.v.) at Halicarnassus in Asia Minor, one of the so-called Seven Wonders of the World (q.v.). Among several Roman copies that may be of his works are the "Apollo Citharoedus" in the Vatican, Rome; a statue of the Greek hero Meleager (q.v.), in the Fogg Art Museum at Harvard University, in Cambridge, Mass.; and a statue known as the "Ludovisi Ares", in the Terme Museum, Rome.

SCOPES TRIAL. See BRYAN, WILLIAM JENNINGS; **FUNDAMENTALISM**.

SCOPOLAMINE or **HYOSCINE**, alkaloid of formula, $C_{17}H_{21}NO_4$, which occurs in the roots of herbs belonging to the Nightshade family, Solanaceae, particularly herbs of the genus, *Hyoscyamus*. A viscous liquid, it dissolves fairly readily in water. The monohydrate of the alkaloid forms crystals of m.p. 59° C. (138° F.). Scopolamine is optically active and rotates the plane of polarized light to the left. The hydrobromide, often handled as the trihydrate, is used medically to dilate the eye, to cause depression of the central nervous system, and as a motion-sickness preventive; its sedative effect in inducing criminal confessions accounts for the popular name, truth drug.

SCORE, in music, notated copy of a composition in which the music to be performed by each voice or instrument is written on staves arranged one above another. The so-called full score shows the music for all the instruments; each player is given a separate score, or part, which shows only his own music. Up to about 1225 all European music for more than one part was apparently circulated in complete scores, and performers read from these scores. The use of such scores was abandoned in the 13th century in order to reduce the space required for writing down a composition. Full scores came into use again in the late 16th century with the rise of the orchestra and the development of orchestration (qq.v.). The earliest example of a printed score was that of the *Madrigali* ("Madrigal", 1577) for voices by the Flemish composer Cyprien de Rore (1516-65). The first printed or-



The scorpion has large clawlike pincers that it uses to seize its prey.
 Jean Philippe Varin-Jacana

chestral score was that of the *Ballet Comique de la Roynie* ("The Comic Ballet of the Roynie", 1582) by the Franco-Italian composer Baltazarini, also known as Balthasar de Beaujoyeux (d. about 1587). Various methods of arranging parts in a score were employed through the middle of the 19th century. Contemporary composers, however, generally follow a method in which the instruments are divided into four groups or choirs consisting respectively of the woodwind, brass, percussion, and stringed instruments, and the instruments within a group are arranged according to their tonal ranges; see also **PITCH**. Reading a modern full score is a difficult skill, complicated by the fact that different clefs (see **MUSICAL NOTATION**) are used in writing the parts of different instruments. For the sake of convenience in reading or study, scores are sometimes arranged in various compressed forms, for example, vocal scores, in which the vocal parts are given in full but the orchestral parts are arranged for the piano, and piano scores, in which all parts are arranged for the piano.

SCORPIO, also called Scorpius or the Scorpion, southern constellation situated partly in the Milky Way (q.v.) next to Libra, and the eighth sign of the zodiac (q.v.). It is represented on pictorial maps as a scorpion. The brightest star in the constellation is Antares, a red star of the first magnitude.

SCORPION, any member of the order Scorpiones, class Arachnida (q.v.). About 650 species of scorpion exist, about 40 of them occurring in the United States. Usually brown in color and ranging from about 1 in. to 8 in. in length, the scorpion has a flat, narrow body, two lobster-like claws, eight legs, and a segmented abdomi-

nal tail. Terminating in a venomous stinger, the tail is usually curved upward and forward over the back. Found in warm and dry tropical regions, including the southwestern United States, the scorpion is nocturnal and feeds mainly on spiders and insects. Squeezing a victim with its claws, the scorpion then inflicts a disabling sting. The sting of the scorpion is painful, but rarely fatal to man. The sting of several species found in Mexico, however, has proved fatal to young children, and one particularly poisonous species is considered capable of delivering a sting fatal to adults.

SCORPION FISH. See **ROCKFISH**.

SCORPIUS. See **SCORPIO**.

SCOTER, common name applied to any of the surf ducks constituting the genera *Oidemia* and *Melanitta*, abundant along the colder shores of the Northern Hemisphere. The birds, which are popularly but erroneously called coots in the United States, feed on marine animals in shallow waters, and have tough, ill-smelling flesh, rendering them unfit for human consumption. Male scoters are chiefly black in color; females and young are chiefly sooty brown. The commonest American species are the white-winged scoter, *Melanitta deglandi*, so called because of a prominent area of white on each wing, and the surf scoter, *M. perspicillata*. The white-winged scoter averages slightly under 2 ft. in length. The surf scoter is somewhat smaller, averaging 19 in. in length, and differs also in having a white crown and a white patch on the neck. Another American species is the common scoter, *Oidemia nigra*. The velvet scoter, *M.*

SCOTLAND

fusca, so called because the male is velvet black, is a European species which is occasionally observed in North America.

SCOTLAND, geographical portion of the island of Great Britain (q.v.), bounded on the N. by the Atlantic Ocean; on the E. by the North Sea; on the S.E. by England (q.v.); on the S. by Solway Firth (q.v.), which partly separates it from England, and by the Irish Sea; and on the W. by North Channel, which separates it from Ireland, and by the Atlantic Ocean. In political geography, Scotland, together with 186 nearby islands, comprises the second largest administrative division (after England) of the United Kingdom of Great Britain and Northern Ireland; see GREAT BRITAIN. A majority of the islands belonging to Scotland are contained in three groups, namely the Hebrides, better known as the Western Isles, situated off the W. coast; the Orkney Islands, situated off the N.E. coast; and the Shetland Islands (qq.v.), situated N.E. of the Orkney Islands. The largest of the other islands is Arran (q.v.). The area, including the islands, is 30,411 sq.mi.

THE LAND

Scotland is shaped very irregularly. The W. coast is deeply penetrated by numerous arms of the sea, most of which are narrow submerged valleys, known locally as lochs, and a number of broad indentations, generally called firths. The principal firths are the Firth of Lorne, the Firth of Clyde (see CLYDE), and Solway Firth. The major indentations on the E. coast are Dornoch Firth, Moray Firth (q.v.), the Firth of Tay, and the Firth of Forth (see FORTH). Measured around the various firths and lochs, the coastline of Scotland is about 2300 mi. long.

From Cape Wrath (q.v.), the N.W. extremity of Scotland, to the Mull of Galloway, the S.W. extremity of Scotland, the distance is about 274 mi. This distance is commonly regarded as the maximum length of Scotland. The width of Scotland varies considerably, ranging from a maximum of about 154 mi., measured along a line extending westward from a point near Peterhead, to about 26 mi., between the respective heads of Dornoch Firth and Loch Broom.

The terrain of Scotland is predominantly mountainous. Physiographically the terrain falls into three distinct divisions, from north to south, the Highlands, the Central Lowlands, and the Southern Uplands. More than one half of the surface of Scotland is occupied by the Highlands, the most rugged region on the island of Great Britain. Consisting of parallel mountain chains with a general N.E.-S.W. trend and broken by deep ravines and valleys, the Highlands are noted for their scenic grandeur. Precipitous

cliffs, moorland plateaus, mountain lakes, sea lochs, swift-flowing streams, and dense thickets are common to the Highlands, the most sparsely inhabited section of Scotland. The uplifts are heavily eroded and fairly uniform in appearance in the district to the N.W. of a depression, known as the Glen More, or Great Glen, which extends from Moray Firth to Loch Linnhe. Numerous peaks from about 2000 to 3000 ft. above sea level are situated in the N.W. coastal area. In the Highlands S.E. of the Great Glen the topography is highly diversified. This region is traversed by the Grampian Mountains (q.v.), the principal mountain system of Scotland. Among the major peaks of the Grampians are Ben Nevis (4405 ft.), the highest summit in Great Britain; Ben Macdui (4298 ft.); and Cairn Gorm (4084 ft.).

The S. limits of the Highlands, which terminate along a line extending southwesterly from Stonehaven to the Firth of Clyde, adjoin the Central Lowlands. A narrow belt comprising about one tenth of the area of Scotland, the Central Lowlands are traversed by several chains of hills, including the Ochil and Sidlaw hills, and by several important rivers, notably the Clyde, Forth, and Tay (qq.v.).

The terrain of the Southern Uplands, a region much less elevated and rugged than the Highlands, consists largely of a moorland plateau traversed by rolling valleys and broken by mountainous outcroppings. Only a few summits in the Southern Uplands exceed 2500 ft. in elevation. Among these summits are Merrick (2765 ft.), the highest, and Cairnsmore (2611 ft.), both in Kirkcudbright County. Adjoining the Upland region along the boundary with England are the Cheviot Hills (q.v.).

The hydrography of Scotland is characterized by an abundance of streams and lakes. Notable among the lakes, which are especially numerous in the central and N. regions, are Loch Lomond (see LOMOND, LOCH), Loch Ness (see NESS, LOCH), Loch Tay, and Loch Katrine. Many of the rivers of Scotland, in particular the rivers in the W., are short, torrential streams, generally of little commercial importance. The chief rivers include, besides those previously cited, the Tweed, Dee (qq.v.), and Spey.

Climate. Like the climate of the rest of Great Britain, that of Scotland is subject to the moderating influences of the contiguous seas. Extreme seasonal variations are rare, as a result of these influences, and temperate winters and cool summers are the outstanding climatic features. Low temperatures, however, are common, during the winter season, in the mountainous districts of the interior. In the W. coastal region,



Scotland. Plate 1. The 15th-century castle of Cawdor, near Nairn in northeastern Scotland, is still the seat of the earl of Cawdor. William Shakespeare, in his play Macbeth, used the castle as the scene for the slaying of King Duncan I by Macbeth, thane of Cawdor, in 1040.

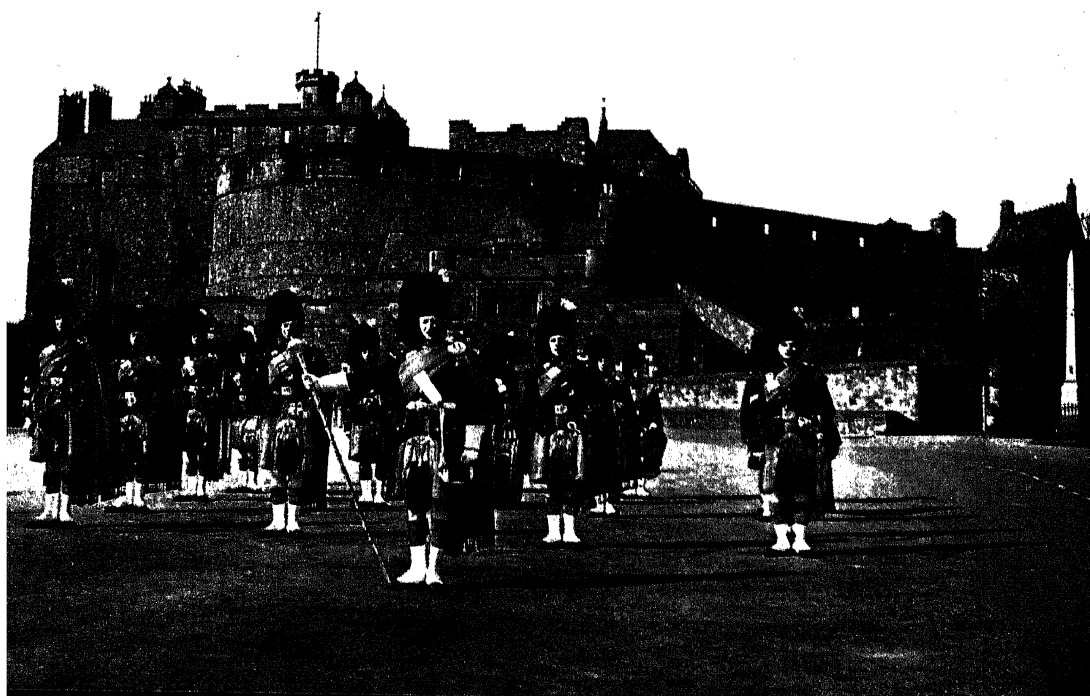
Don Hunstain - Alpha Photo Associates



J. Pugh - Alpha Photo Associates

Scotland. Plate 2. Above: Dancing competition is an integral part of the Highland Games, athletic meetings held annually in numerous Scottish communities and in other places throughout the world. Women dancers were admitted to competition at some meetings only in the early years of this century. Below: Colorfully uniformed troops perform the tattoo, an evening military exercise, at Edinburgh Castle. The ancient fortress stands on a rock dominating the city of Edinburgh.

Alpha Photo Associates



which is subject to the moderating effects of the Gulf Stream, conditions are somewhat milder than in the *ε*. The average January temperatures of the *ε*. and *w*. coastal regions are respectively 39° F. and 37.5° F.; corresponding July averages are 56.8° F. and 59° F. The prevailing winds are from the *s.w*. Precipitation, which is marked by regional variations, ranges from about 150 in. annually in the *w*. Highlands to about 25 in. annually in certain *ε*. areas.

Natural Resources. Scotland, like the rest of the island of Great Britain, has significant reserves of coal. It also possesses large deposits of zinc, chiefly in Dumfries County. The soil is generally rocky and infertile, except for that of the Central Lowlands. The hydrography of *N*. Scotland is particularly favorable to hydroelectric generation, and efforts have been made to develop the power potential. In the late 1960's generating stations produced more than 3,000,000 kw hours of electric power annually.

Plants and Animals. The most common species of trees indigenous to Scotland are oak and conifers, chiefly fir, pine, and larch. Large forested areas are rare, however, and the only important woodlands are in the *s*. and *ε*. Highlands. Except in these wooded areas, vegetation in the elevated regions consists largely of heather, ferns, mosses, and grasses. Saxifrage, mountain willow, and other types of alpine and arctic flora occur at elevations above 2000 ft. Practically all of the cultivated plants of Scotland were imported from America and the European continent.

The only large indigenous mammal in Scotland is the deer. Both the red deer and the roe deer are found, but the red deer, whose habitat is the Highlands, is by far the more abundant of the two species. More than 2,000,000 acres of so-called deer forests, principally treeless tracts for the keeping and hunting of deer, are maintained in Scotland. Other indigenous mammals are the hare, rabbit, otter, ermine, pine marten, and wildcat. Game birds include grouse, blackcock, ptarmigan, and waterfowl. The few predatory birds include the kite, osprey, and golden eagle. Salmon and trout abound in the streams and lakes, and many species of fish, including cod, haddock, herring, and various types of shellfish, are found in the coastal waters.

THE PEOPLE

The people of Scotland, like those of Great Britain in general, descend from varied racial stocks, including the Picts, Celts, Scandinavians, and Romans. Scotland is a mixed rural-industrial society. Scots divide themselves into Highland-

ers, who consider themselves of purer Celtic blood and retain a stronger feeling of the clan, and Lowlanders, who are largely of Teutonic blood.

Population. The population of Scotland was (1971 census) 5,227,706. The population density was about 175 persons per sq.mi. The highest density is in the Central Lowlands, where three quarters of the Scots live, and the lowest is in the Highlands. About two thirds of the population are urban dwellers.

Political Divisions. For purposes of local government, Scotland is divided into thirty-three civil counties: Aberdeen, Angus (also known as Forfar), Argyll, Ayr, Banff, Berwick, Bute, Caithness, Clackmannan, Dumfries, Dunbarton, East Lothian, Fife, Inverness, Kincardine, Kinross, Kirkcudbright, Lanark, Midlothian, Moray, Nairn, Orkney, Peebles, Perth, Renfrew, Ross and Cromarty, Roxburgh, Selkirk, Stirling, Sutherland, West Lothian, Wigtown, and Zetland. See separate articles on most of the foregoing counties.

PRINCIPAL CITIES. Edinburgh (q.v.) is the administrative center and second largest city; its population in 1971 was 543,025. The most populous city (893,790) is Glasgow (q.v.). The conurbation of Clydeside, which includes the cities of Glasgow and Clydebank, is the largest shipbuilding and marine engineering center in Great Britain. Other important industrial cities are Dundee (182,930) and Aberdeen (181,785).

Religion and Language. The Church of Scotland, a Presbyterian denomination, is the official state church; see SCOTLAND, CHURCH OF. The Roman Catholic Church is second in importance. Other leading denominations are the Episcopal Church in Scotland, Congregationalist, Baptist, Methodist, and Unitarian. Jews comprise a small minority.

English is generally spoken, but some 100,000 Scots speak primarily the Scottish form of Gaelic.

Education. Schools in Scotland are organized and administered as in the other parts of Great Britain. See GREAT BRITAIN: *Education*.

ELEMENTARY AND SECONDARY SCHOOLS. In the early 1970's some 964,000 pupils were attending publicly maintained or direct-grant schools, and more than 17,000 were in private schools. The transfer from elementary to secondary schools generally takes place at the age of twelve. For a discussion on specialized schools, see ENGLAND: *Education*.

UNIVERSITIES AND COLLEGES. Scotland has about ninety institutions providing programs of study beyond the secondary level for those students



Scottish girl dressed in traditional clan tartan, performs the rapid footwork of a sword dance over a crossed saber and scabbard at the Highland Games in Glasgow.

British Information Services

who do not go on to the universities. These include colleges of agriculture, art, commerce, and science, and in the early 1970's the total enrollment was over 157,000. Teacher-training colleges numbered ten, with approximately 14,000 students. The oldest universities in Scotland (Aberdeen, Edinburgh, Glasgow, and Saint Andrews, qq.v.), were founded in the 15th and 16th centuries. Four universities have received their charters since 1960. Total university enrollment was about 36,500 in the early 1970's.

Culture. Clans, the traditional keystone of Scottish society, are no longer powerful; see CLAN. Originally, the clan, a grouping of an entire family with one head, or laird, was also important as a fighting unit. The history of inter-clan battles is long and sanguinary, and feuds often developed within clans as well. Scottish folk ballads relate many stories of treachery and sudden death. Many clans still meet annually. Kilts woven in the clan tartan are worn only on special occasions. The solidarity associated with clan membership has been expanded into a strong national pride. The Puritan zeal of Scottish Presbyterianism, which is traceable to John Knox (q.v.), the 16th-century religious reformer

and statesman, is also strong. Popular sports of Scottish origin include curling and golf (qq.v.).

LANGUAGE AND LITERATURE. See SCOTTISH LANGUAGE AND LITERATURE.

ART. Mainly because of the dominance of Flemish and Dutch masters who lived in both England and Scotland, no Scottish artist of note emerged before the 18th century. Allan Ramsay (1713–84), Scottish-born portraitist, was strongly influenced by the English painter Joshua Reynolds (q.v.). Sir Henry Raeburn (q.v.), of Edinburgh, was a self-taught portrait artist. Charles Rennie Mackintosh (1868–1928) was among the first Scottish architects and designers to base his designs on the flexibility afforded by new types of construction materials.

MUSIC. Little is known of the origins of Scottish folk music. Bagpipes, usually associated with Scottish music, were probably introduced by the Romans, who acquired them in the Middle East. Scottish music is noted for the wide use of a five-tone, or pentatonic, scale. Folk tunes are not standardized and a single song may have hundreds of variations in lyrics and music.

THE ECONOMY

Many aspects of the economy of Scotland are covered in GREAT BRITAIN: *The Economy*. The currency of Great Britain is the legal tender of Scotland. Both agriculture and industry are important in the economy of Scotland. The chief exports are manufactured goods, especially burlap, clothing, machinery, textiles, and whiskey. The chief imports are food, iron, and crude oil. The center of Scottish trade unionism is the Scottish Trades Union Congress, with an affiliated membership of 800,000.

Agriculture. More than three fourths of the land is used for farming and grazing. The most important crops are cereals, notably wheat and oats; the annual yield in the early 1970's was valued at about \$6,800,000 for cereals and about \$35,000,000 for potatoes. Livestock and livestock products are also of major importance. In the early 1970's the livestock population was estimated at about 5,400,000 sheep, 2,200,000 cattle, 600,000 hogs, and 13,200,000 poultry of various types.

Forest and Fishing Industries. About 1,480,000 acres were forested, 60 percent of which were publicly owned. In Scotland fishing is more important than forestry. The total annual value of fish landed in the early 1970's was about \$63,000,000, and the catch mainly consisted of whitefish, herring, crabs, and lobsters.

Mining and Manufacturing. Coal is the chief mineral wealth, and the industry is nationalized. In the early 1970's the average yearly output was

about 11,300,000 tons. Limestone, clay, and silica are also mined. Iron ores and other metals have been virtually exhausted.

About 36 percent of the labor force is employed in manufacturing. Shipbuilding is a major industry, and in the early 1970's some 44,000 workers were employed in shipbuilding and marine engineering. Manufactures include woolen textiles and yarn, chemicals, machinery of many types, vehicles, and whiskey.

Transportation and Communications. About 29,000 mi. of highways and 4000 mi. of railroads cover Scotland. Public buses provide transportation throughout most of the country, and many transatlantic flights use Prestwick airport. Telephones and telegraph link all parts of Scotland. Most radio and television programs originate in England. About 17 daily newspapers and 120 weeklies are published in the country.

GOVERNMENT

Scotland is governed as an integral part of Great Britain. See GREAT BRITAIN: *Government*. It is represented by 71 members in the House of Commons and by 16 Scottish peers in the House of Lords.

Central Government. Scottish affairs are administered by a British cabinet ministry, headed by the secretary of state for Scotland.

The statutory functions of the secretary of state are discharged by four main departments of equal status: the Department of Agriculture and Fisheries for Scotland, the Scottish Development Department, the Scottish Education Department, and the Scottish Home and Health Department. Each is under a secretary responsible to the secretary of state. The routine administration of the departments is conducted in Edinburgh, but each department has representatives in London to perform liaison and parliamentary duties.

Legislature. Prior to the union of Scotland and England in 1707, Scotland had developed its own system of law, which it retained after the union. The Scottish law system is based on civil law (q.v.), which derives from ancient Roman law (q.v.), whereas the other parts of Great Britain follow the common law (q.v.), which originated substantially in England. Because of the different legal systems, separate statutes or statutory provisions often must be enacted by Parliament for Scotland. Any statute must state expressly or imply that it is applicable to Scotland in order to become enforceable in that administrative division of Great Britain. See also ENGLAND: *English Law*.

Local Government and Political Parties. The Scottish Development Department is responsi-

ble for general policy in regard to local government. Local government in Scotland is similar to that in the rest of Great Britain. Scotland is divided into 33 counties, 200 burghs, and 198 districts. Included in the burghs are four counties of cities (Glasgow, Edinburgh, Aberdeen, and Dundee) and they are completely independent of their counties except for education and some police functions.

Two leading British parties, the Conservative Party and the Labour Party (qq.v.), have shared Scottish seats in Parliament about equally since the 1920's. See GREAT BRITAIN: *Political Parties*. The Scottish Nationalist Party, which was founded in 1927 in order to press for complete self-government, has played a minor role in the politics of the country.

Judiciary. The Scottish judiciary is organized separately from that of the rest of Great Britain. The two higher courts, the High Court of Justiciary and the Court of Session, are for criminal and civil cases, respectively. A panel of 18 judges is provided for both courts together. Major criminal trials are held before 1 or 2 judges of the High Court of Justiciary and a 15-member jury; criminal appeals may be heard by a bench of at least 3 judges. The Court of Session is divided into an Outer House, which holds all divorce trials and the more important civil trials, and an Inner House, which functions chiefly as an appellate court in civil cases. Appeals to the British House of Lords may be made from the Court of Session; appellate judgments of the High Court of Justiciary are final.

Each of the twelve sheriffdoms, into which Scotland is divided, has a sheriff court for the trial of less important civil and criminal cases. Petty cases are tried by police courts and justices of the peace.

HISTORY

The region comprising present-day Scotland was known in antiquity as Caledonia after the Roman invasion of Britain (qq.v.). With the sole exception of the Picts (q.v.), the ancient Caledonians do not figure in history.

Roman Caledonia. The Picts, a fierce and warlike people, successfully resisted conquest by the Romans, whose great general Gnaeus Julius Agricola (q.v.) led the first invasion of Caledonia late in the 1st century A.D. Agricola and his legions pushed northward to the Firth of Forth. The border Picts, probably joined by rebellious Britons (q.v.), strenuously contested Roman sovereignty in the region between the firths of Forth and Clyde. In 122 A.D. to ward off the Pictish threat to the imperial positions in northern Britain the Roman emperor Hadrian (q.v.) or-

SCOTLAND

dered construction of a rampart from Solway Firth to the mouth of the Tyne R. Remnants of this rampart, known in history as Hadrian's Wall (q.v.), are still extant. Two decades later another rampart, called the Wall of Pius, was constructed from the Firth of Forth to the Firth of Clyde. The territory between the two walls served as a firstline defense area against the Caledonians for the duration of Roman occupation.

Early Scottish Kingdoms. After the Roman withdrawal from Britain in 409, the Picts systematically raided the territories of their southern neighbors. The latter soon halted these raids, probably with the assistance of the Saxons (q.v.), one of the Teutonic (see **TEUTON**) tribes that subsequently subjugated the Britons. In the course of the Teutonic conquest many Britons withdrew into the Caledonian region between the Firth of Clyde and Solway Firth, laying the foundations of what became the kingdom of Strathclyde. The adjacent region to the north, comprising mainly what is now Argyll County, was occupied toward the beginning of the 6th century by the Scots, Celtic invaders from northern Ireland, who established the kingdom known in history as Dalriada; see **CELTIC PEOPLES AND LANGUAGES**. About the middle of the 6th century the Angles (q.v.), Teutonic colleagues of the Saxons, overran most of Caledonia south of the Firth of Forth and east of Strathclyde. Together with the extensive Angle holdings in the north of what is now England, this region became the kingdom of Northumbria (q.v.).

During the period of Angle penetration in Caledonia, Christianity was widely disseminated among the Picts by Saint Columba (q.v.), an Irish missionary who came to Dalriada from northern Ireland in 563. Strathclyde and various parts of Pictland had been converted to Christianity before the time of Columba. Between 655 and 664, Scottish missionaries were active in Northumbria, which was then the center of a pagan revival.

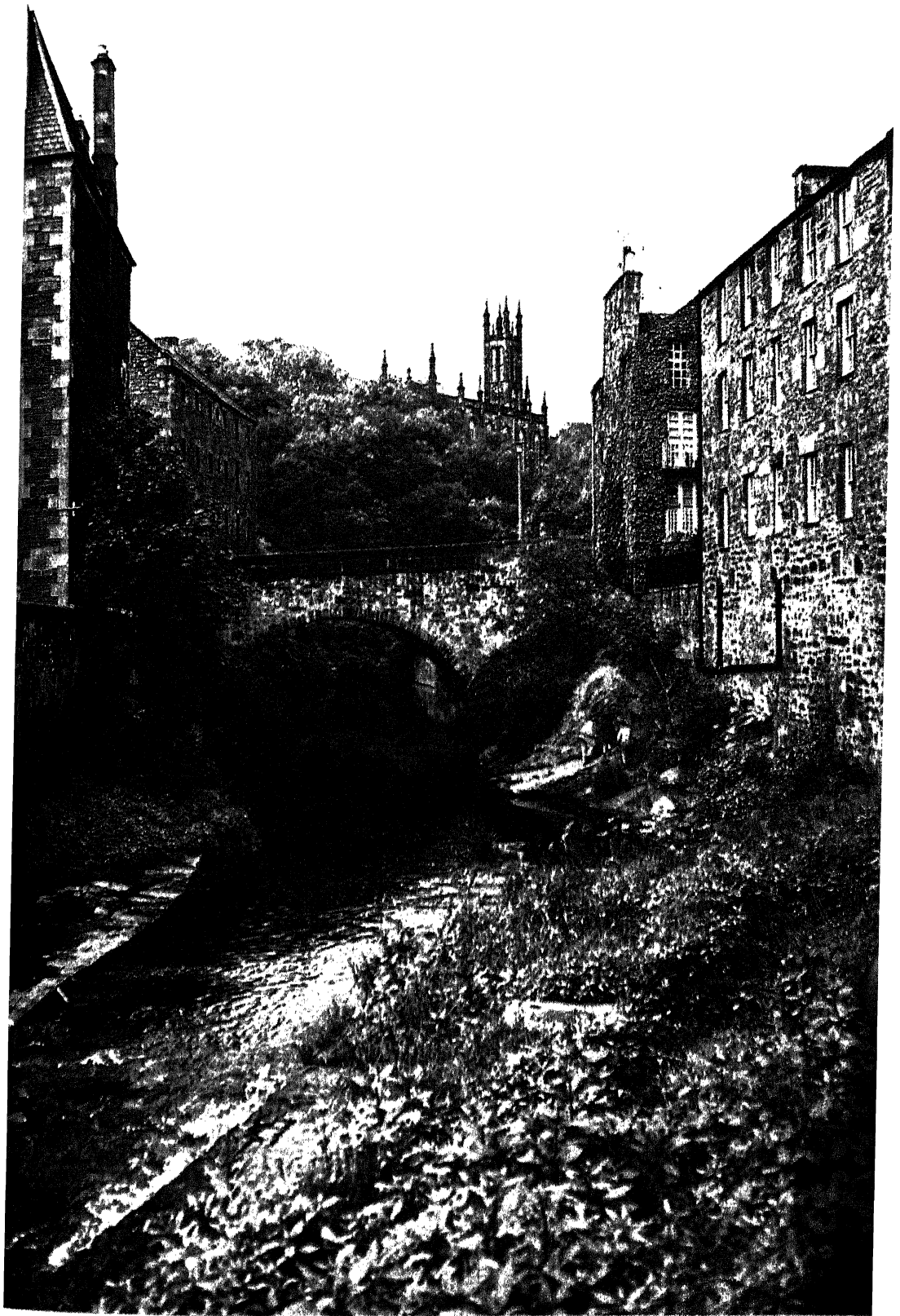
The Unification of Scotland. In 685 Pictish territory north of the Firth of Forth was invaded by a large Northumbrian army. An overwhelming Pictish victory permanently weakened Angle power in Caledonia. About 730 Angus MacFergus, King of the Picts, subjugated Strathclyde and Dalriada. Relative peace followed until the late 8th century when Norsemen (q.v.) began to raid the Caledonian coasts. Taking advantage of Pictish preoccupation with the invaders, the Scots and Britons shortly regained their independence. In 844 Kenneth MacAlpine, King of Dalriada, and later King of Scotland (see *under*

KENNETH), a descendant of the Pictish royal family, obtained the crown of Pictland, probably with the assent of the harassed Picts. The united kingdoms, officially known as Alban, comprised all of the territory north of the firths of Forth and Clyde. Kenneth and several of his successors vainly attempted to subdue the remaining Northumbrian possessions in Caledonia and, in alliance with Strathclyde, tried to halt the raids of the Norsemen. Although, with the help of the Angles, the Norsemen were prevented from securing a foothold in Dalriada, they seized various coastal areas in the north, east, and west, and occupied the Orkney and Shetland islands and the Hebrides. In later times the rulers of England claimed the Scottish domain on the basis of the aid their forebears had given to Ablan.

In the 10th century the Alban kings, having repulsed the Norsemen, repeatedly attacked the Northumbrian strongholds south of the Firth of Clyde. All of these attacks ended in failure. During the reign (1005–34) of Malcolm II Mackenneth (d. 1034), the Northumbrians were decisively defeated in the Battle of Carham in 1018. With this event and as a result of the inheritance of the crown of Strathclyde by Malcolm's grandson and successor Duncan I (see *under* **DUNCAN**), the Scottish domains, thereafter known as Scotland, embraced all of the island north of Solway Firth and the Tweed R.

Duncan's reign, a period of disastrous wars and internal strife, was ended in 1040 with his assassination by Macbeth (q.v.), Mormaor (great steward) of Ross and Moray, and later King of Scotland, who was immortalized in William Shakespeare's celebrated tragedy. Macbeth held the throne of Scotland until 1057, when he was defeated and killed by Duncan's son Malcolm Canmore.

The Anglicization of Scotland. The accession in 1059 of Malcolm Canmore, as Malcolm III MacDuncan (d. 1093), introduced a new era in Scotland, an era marked by fundamental transformations of the ancient Celtic culture and institutions. Long an exile among the English, Malcolm had acquired a profound interest in their customs and affairs. The consequent trend toward Anglicization of his realm was sharply accelerated when, in 1067, he married Margaret, later canonized as Saint Margaret (about 1045–93), an English princess who had been forced into exile in Scotland by the Norman Conquest in 1066. Under the influence of Margaret, a devout communicant of the Church of Rome, many of the teachings of the Celtic Church were brought into harmony with the Roman rit-



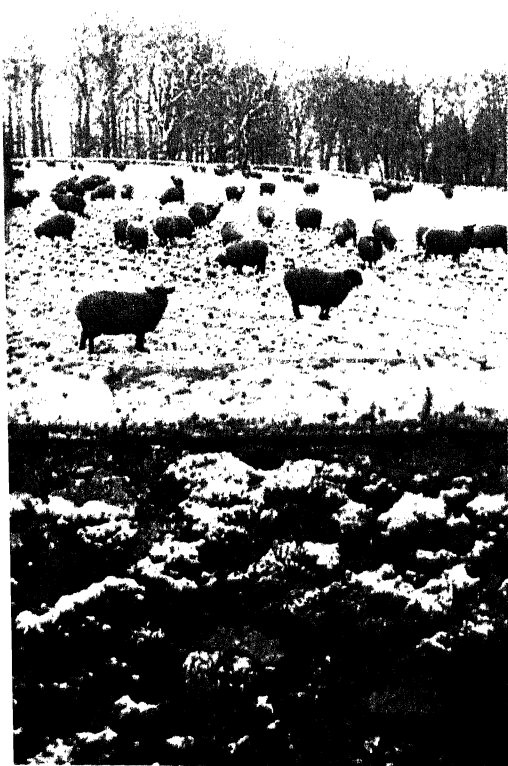
Scotland, Plate 3. A scene in the old town of Edinburgh. The section, built on a rock sloping down from Edinburgh Castle, abounds in steep narrow streets and hidden courtyards.

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David Hurn - Magnum

Scotland. Plate 4. Above: Loch Eil, between Inverness and Argyll counties, one of innumerable nearly landlocked inlets in western Scotland. Below, left: Sheep graze in lush pasturelands. Sheep raising is an important segment of the agriculture of Scotland. Below, right: Fishermen congregate at the harbor of a coastal town. Fishing is a major activity in Scotland, as a village trade, a tourist sport, and an industry.



David Hurn - Magnum



Erich Hartmann - Magnum

ual. The hostility engendered among many of the Scottish chieftains by Margaret's activities flared into rebellion on the death of Malcolm. Margaret, her step-son Duncan, later Duncan II, King of Scotland (see *under* DUNCAN) and their English retainers were driven from Scotland. With Anglo-Norman help the rebellion, which had been led by Donald Bane (about 1033–97), a brother of Malcolm III, was crushed. In 1097 Edgar (about 1074–1107) one of the six sons of Malcolm and Margaret, ascended the Scottish throne.

The Anglicization of Scotland acquired tremendous momentum during Edgar's reign, from 1097 to 1107, and the reigns of his brothers Alexander I (see *under* ALEXANDER), from 1107 to 1124, and David I (q.v.), from 1124 to 1153. Under these monarchs, all of whom had been deeply influenced by their mother's religious and cultural views, the Anglo-Norman feudal system (see FEUDALISM) was established in Scotland. The reorganization was confined at first to ecclesiastical reforms, but it gradually affected all sectors of Scottish life. Celtic religious orders were suppressed, English ecclesiastics replaced Scottish monks, numerous monasteries were founded, and the Celtic Church was remodeled in conformity with Roman practice. English supplanted the Gaelic language (q.v.) in court circles, the border areas, and many parts of the Lowlands. The traditional system of tribal land tenure was abolished during the reign of David I; see CLAN. Claiming universal ownership of the land, he conveyed huge grants, particularly in central and southern Scotland, to Anglo-Norman and Scottish nobles, who thereby became loyal vassals of the crown. David I also instituted various judicial, legislative, and administrative reforms, all based on English models, encouraged the development of commerce with England, and granted extensive privileges to the Scottish burghs.

Relations With England. Political relations with England were disturbed, during David's reign, by disputes over certain border areas, notably that portion of Northumbria south of the Tweed. In 1138 and again in 1149 the Scottish king, seeking to extend his dominions southward, supported abortive attempts to dethrone the reigning monarch of England. As a result of the intervention of 1149, Northumbria, which had been granted previously to Scotland reverted to English ownership. David's grandson William the Lion (q.v.), who was crowned King of Scotland in 1165, attempted to regain Northumbria by giving military aid to a rebellion in 1173–74 against Henry II (q.v.), King of England.

In 1174 William was taken prisoner and compelled, by the provisions of the treaty of Falaise, to swear fealty to the king of England. Although Richard I (q.v.), King of England annulled the treaty, in 1189, in exchange for 10,000 marks of silver, English claims to sovereignty over Scotland were based thereafter on precedent as well as on the 10th-century alliances against the Norsemen. Alexander II (see *under* ALEXANDER), William's son and successor, renounced Scottish claims to Northumbria and other territories in northern England, in 1237, beginning a period of friendly relations between the two nations. In 1266, following a victorious war against Norway, Alexander III (see *under* ALEXANDER) recovered the Hebrides.

Alexander III died in 1286, leaving the throne to Margaret, known as the Maid of Norway (1283–90), his infant granddaughter and only living descendant. The death of Margaret produced a political crisis in Scotland, with no less than thirteen descendants of former monarchs laying claim to the throne. In this situation Edward I (q.v.), King of England, proclaiming suzerainty over Scotland, intervened on behalf of John de Baliol (see *under* BALIOL), a grandson of David I and, aside from Robert de Bruce VI (see *under* BRUCE), another grandson of David, the chief pretender to the throne. Certain sections of the Scottish nobility formally recognized the English king's overlordship in Scotland. In November, 1292, after leading an army into his vassal realm, Edward I proclaimed John de Baliol king of Scotland.

The War for Independence. Many Scottish nobles and the overwhelming majority of the Scottish people bitterly resented English interference in their national affairs. Acceding to popular demand for termination of English control, Baliol formed an alliance, in 1295, with France, which was then at war with England, and summoned his people to revolt. The first phase of the Scottish war of independence ended victoriously for Edward I, who crushed Baliol's army at Dunbar in April, 1296, and decreed the annexation of Scotland to England. Baliol was deposed, and his former kingdom was placed under military occupation.

The Scottish struggle against England was resumed, in 1297, under the leadership of the Scottish patriot Sir William Wallace (q.v.). With soldiers recruited from all sections of the nation, Wallace destroyed an English army at Stirling on Sept. 11 and, acting as the agent of John de Baliol, reinstituted Scottish rule. Edward I led a huge army into Scotland in the following year and, on July 22, at Falkirk, won a decisive vic-

SCOTLAND

tory. After this setback Wallace waged incessant guerrilla warfare against the English. He was outlawed by Edward in 1304, following another large-scale English invasion. In 1305 Wallace was betrayed to the English, convicted of treason, and executed.

Robert Bruce (q.v.), a grandson of the previously cited pretender to the Scottish throne, assumed the leadership of the resistance movement after Wallace's death. Although Bruce had opposed Wallace, most of the Scottish nobility and clergy rallied to his support. He was crowned Robert I, King of Scotland, in March, 1306. During the first year of his reign Bruce suffered several reverses at the hands of the English. In 1307, on the accession to the English throne of Edward II (q.v.), who abandoned his father's plan to subjugate Scotland, Bruce began a systematic guerrilla campaign against the pro-English section of the Scottish nobility and against English garrisons in Scotland. Between 1307 and 1314 he won innumerable battles against his enemies and, on a number of occasions, even invaded northern England. Edward II finally led a punitive expedition into Scotland in the spring of 1314. Meeting this invasion force at Bannockburn on June 24, the Scottish army inflicted on it the most disastrous defeat in the military annals of England; see *BANNOCKBURN, BATTLE OF*. Edward II refused to grant independence to Scotland, however, and the war between the two nations continued for more than a decade. In 1326, during this phase of the struggle, the common people of Scotland secured representation, for the first time, in the Scottish parliament. The war against England ended victoriously when, in 1328, the regents of the young Edward III (q.v.), King of England, approved the Treaty of Northampton. By the terms of this document, Scotland obtained recognition as an independent kingdom.

For more than 200 years after Bruce's death and the accession of his infant son as David II (q.v.), Scotland was the scene of almost continuous strife among the nobility. The feudal anarchy was especially pronounced because of the prevalence of the clan system in the Highlands and various other areas. In these regions, where close personal relations existed among the clan members and their chiefs, the latter were powerful and contemptuous of royal authority; see *DOUGLAS*. The period was also marked by almost uninterrupted warfare with England.

Within four years after the conclusion of the Treaty of Northampton, Edward III renewed the struggle to reduce Scotland to vassalage. Initially, this venture took the form of support to

Edward de Baliol (see under *BALIOI*), a son of John de Baliol and a pretender to the Scottish crown. Baliol invaded Scotland from England in 1332, and after winning a victory at Dupplin Moor had himself crowned king. He was shortly driven from Scotland. In 1333 Edward III led an army northward and routed the Scots near Berwick-upon-Tweed. The English king thereupon occupied a large part of southeastern Scotland. In 1337, after his involvement in war with France, he abandoned Baliol and neglected his Scottish possessions; see *HUNDRED YEARS' WAR*. By 1341 the Scots had liberated several of the more important occupied areas, including Edinburgh. In 1346 David II, having rejected an English plea to renounce the Franco-Scottish alliance of 1295, led an invasion of northern England in support of the French war effort. The Scottish army was defeated near Durham on October 17, and the king was taken prisoner. A large section of southern Scotland was immediately reoccupied by the English. In 1357, after the Scots agreed to pay an enormous ransom to England, David was released.

The Stuart Kings. Still loyal to the alliance with France, the Scots again attacked the English in 1377, during the reign (1371–90) of Robert II (q.v.), a grandson of Robert Bruce and founder of the Stuart (q.v.) dynasty of Scottish kings. Because of the feudal turmoil then raging in Scotland, the nation was unable to defend itself against the English counteroffensive, and many communities were devastated. Royal authority practically disappeared in Scotland during the reign (1390–1406) of Robert III (q.v.). On the death of the latter his son James, then a prisoner in England, inherited the crown as James I (q.v.). After his release in 1424 and return to Scotland, James I attempted to restore order in the strife-torn country. He imposed various curbs on the nobility and secured parliamentary approval of a number of legislative reforms. Without the co-operation of the feudal barons, however, these reforms were unenforceable. James I was murdered by a rebellious noble in 1437.

During the remainder of the 15th century the successors of James I, namely James II, James III, and James IV (qq.v.), sought to impose restraints on the turbulent nobility, but significant results were accomplished only by James IV. The alliance with France was maintained, and by 1460 the English had been expelled from southern Scotland. Among other outstanding developments of the 15th century was the recovery, through the marriage of James III to a Danish princess, of the Orkney and Shetland islands.

Shortly after the turn of the century James IV married Margaret Tudor, daughter of Henry VII (qq.v.), King of England. The friendly political relations which preceded and followed the union of the royal houses of Scotland and England began to deteriorate after the accession in 1509 of Henry VIII (q.v.), King of England. Refusal of James IV to end the Scottish alliance with France, against which England and several continental powers had formed the Holy League in 1511, was the principal source of friction between the two nations. In 1513, after Henry VIII invaded France, James IV led an army into England. The Scots and English met, on September 9, at Flodden Field; see FLODDEN. James IV was killed and his army was routed.

Despite the development of a powerful pro-English faction in Scotland after the death of James IV, the regents in control of the kingdom during the infancy of his son and successor James V (q.v.) preserved the French alliance. This policy was perpetuated by James V, who assumed control of the kingdom in 1528, and by his chief advisor David Beaton (q.v.), later cardinal of the Roman Catholic Church. Following the rupture in 1529 between Henry VIII and the Church, the Scottish king resisted Henry's efforts to enlist Scotland on the side of fundamental ecclesiastical reform and to secure an end to the Franco-Scottish alliance. The Protestant Reformation shortly began to gain headway in Scotland, particularly among the anti-French faction; see REFORMATION: *Scotland*. In 1538 James V married Mary of Guise (1515–60), a member of the royal family of France, further alienating the Scottish nobility and people. The antagonisms between James V and Henry VIII precipitated, in 1542, another conflict. In the first major battle, which was fought at Solway Moss in November, 1542, the Scottish army, consisting mainly of Roman Catholics, was badly defeated.

James V survived the debacle at Solway Moss by only a few weeks. The crown of Scotland thereupon passed to his week-old daughter, known as Mary, Queen of Scots (q.v.). Among the first acts of the infant queen's regent James Hamilton, 2nd Earl of Arran (1515?–75), was the confinement of Cardinal Beaton. This act and Hamilton's sympathies with the Reformation presaged friendlier relations with England. As a result of atrocities committed by English troops in southern Scotland in 1544–45, however, the Scottish government strengthened its alliance with France. In 1548 Mary, Queen of Scots, who had been betrothed previously to the French heir apparent, was sent to France.

Mary of Guise assumed the regency in 1554. In consequence of her policies, seemingly designed to transform Scotland into a colony of France, a widespread resurgence of anti-French sentiment developed in the kingdom. The return to Scotland, in 1559, of John Knox (q.v.), a Protestant leader who had been exiled, added to the political ferment and gave impetus to the Reformation; see COVENANTERS. The general hostility to Mary of Guise was deepened by the marriage, in April, 1558, of her daughter to the dauphin of France. In 1559, following the queen mother's denunciation of Protestants as heretics, Knox and his followers resorted to open rebellion. Elizabeth I (q.v.), Queen of England, began at once to provide the insurgents with military and financial aid. An English fleet laid siege to Edinburgh, a center of French power in Scotland, in 1560. Hostilities were concluded, before the end of the year, by the Treaty of Edinburgh, which included provisions for the withdrawal of French and English forces from Scotland and for a regency during the remainder of Queen Mary's minority. In the same year the Scottish Protestant leaders, assembled in a special parliament, abolished the Roman Catholic Church in Scotland and adopted a Calvinistic Confession of Faith; see CALVINISM: PRESBYTERIANISM. Mary of Guise had died in June, 1560, shortly after her deposition as regent. In August, 1561, Queen Mary, whose husband had died within a year of his coronation as Francis II (q.v.), King of France, returned to her native land.

A loyal Roman Catholic and the heir presumptive to the English throne, Queen Mary quickly became the central figure of the Counter-Reformation in Scotland and (later) in England. The final contest between Scottish Protestantism and Catholicism developed against a background of unprecedented political intrigue. The struggle, which was marked by many dramatic events, including conspiracy, murder, rebellion, and civil war, culminated in the beheading in 1587 of Mary. In addition to the article MARY, QUEEN OF SCOTS, the articles dealing with her leading associates contain detailed information on this period of Scottish history. See BABINGTON, ANTHONY; BOTHWELL, JAMES HEPBURN, 4TH EARL OF; DARNLEY, HENRY STEWART, LORD; RIZZIO, DAVID; WALSINGHAM, SIR FRANCIS.

Union with England. For almost fourteen years after the abdication in 1567 of Queen Mary, Scotland was ruled by successive regents. These individuals, all staunchly Protestant and pro-English, functioned on behalf of Mary's son James, who was born in 1566 of her union with Lord Darnley. In 1581 James became head of the

SCOTLAND, CHURCH OF

Scottish government as James IV. For a brief period the young monarch was under the influence of Roman Catholic advisers. Vigorous action by the Protestant nobility forced him to get rid of these favorites and to adopt a friendly attitude toward England. Various other considerations, including his status as the heir presumptive to the English crown and the imminent threat of a Spanish invasion of England (see ARMADA), prompted James to suppress outward manifestations of his sympathy with Catholicism. In 1585 he concluded a military alliance with Elizabeth, subsequently refusing to intercede on behalf of his condemned mother. While James later pursued a vacillatory policy with respect to Catholicism, he never abandoned his fundamental hostility to Presbyterianism. His religious views earned him the hatred of the radical faction among Scottish Protestants. After the Gowrie Conspiracy in 1600, an alleged plot to kill James, he repressed the Protestants as he had the Catholics. He was a capable administrator, however, and made the power of the monarchy dominant in Scotland.

On the death of Elizabeth, in March, 1603, James VI inherited the crown of England as James I (q.v.), King of Great Britain. Although the legislative union of the merged realms was not consummated until 1707, the next phase of the history of Scotland is properly included in the history of Great Britain (q.v.).

RULERS OF SCOTLAND

Name	Reign
Malcolm II Mackenneth	1005-1034
Duncan I	1034-1040
Macbeth	1040-1057
Malcolm III MacDuncan	1057-1093
Donald Bane	1093-1094
Duncan II	1094
Donald Bane (restored)	1095-1097
Edgar	1097-1107
Alexander I	1107-1124
David I	1124-1153
Malcolm IV	1153-1165
William the Lion	1165-1214
Alexander II	1214-1249
Alexander III	1249-1286
Margaret	1286-1290
(Interregnum)	1290-1292
John de Bailiol	1292-1296
(Interregnum)	1296-1306
Robert I (Bruce)	1306-1329
David II (Bruce)	1329-1371
Robert II	1371-1390
Robert III	1390-1406
James I	1406-1437
James II	1437-1460
James III	1460-1488
James IV	1488-1513
James V	1513-1542
Mary, Queen of Scots	1542-1567
James VI*	1567-1625

* King of Great Britain as James I after 1603.

SCOTLAND, CHURCH OF, also called THE AULD KIRK (Scottish, "Old Church"), national Scottish church, organized during the period of

the Reformation (q.v.) in Scotland; see SCOTLAND: *History*. Calvinist in doctrine and Presbyterian in polity, the Church of Scotland numbers among its communicants the majority of Presbyterians in Scotland. Despite its strong national character, the Scottish church is altogether free from state intervention and dictation. See CALVINISM; PRESBYTERIANISM.

History. The earliest movement toward the establishment of the Protestant faith in Scotland was the drawing up of the First Covenant (see COVENANTERS), otherwise known as the Congregation of the Lord. This instrument, signed at Edinburgh on Dec. 3, 1557, by many of the most powerful barons and by large numbers of the lesser nobility, elicited from Mary of Guise (1515-60), the pro-Catholic queen regent of Scotland, a proclamation forbidding any of her subjects to preach or administer the sacraments (see SACRAMENT) without the authorization of a bishop (q.v.). The proponents of the Reformation triumphed, however, and in 1560, following the deposition of Mary of Guise and the conclusion of an alliance between the Scottish and English Protestants, the parliament of Scotland abolished the Roman Catholic form of worship and appointed Protestant ministers to various parts of the kingdom. At the same time parliamentary ratification was accorded to the so-called Scots Confession, a confession of faith composed for the most part by the Scottish reformer John Knox (q.v.) and conforming to the Confessions adopted by the Reformed Churches of the Continent; see CREEDS; REFORMED CHURCHES. Knox likewise took the lead in drafting the *First Book of Discipline* (1560), a comprehensive constitution for the Scottish reformed church.

On Dec. 20, 1560, the first general assembly of the Church of Scotland was convened in Edinburgh. As a result of the unremitting exertions of Knox and another religious reformer, Andrew Melville (1545-1622), complete recognition was at last obtained for Presbyterian Calvinism as the established religion of Scotland. The *Second Book of Discipline* was adopted in 1577. This recognition was signaled in 1592 by the consent of the pro-Catholic king of Scotland, James VI, later James I (q.v.), King of Great Britain, to the passage by the Scottish parliament of the so-called Golden Act, which imparted legal standing to the Presbyterian ecclesiastical courts and rescinded previous legislation giving the king absolute jurisdiction over church government. James, however, subsequent to the union of the crowns of Scotland and Great Britain in 1603 (see GREAT BRITAIN: *History*), took steps to reim-

pose his episcopal authority upon his Scottish subjects. In this policy he was followed by his successors Charles I, Charles II, and James II (qq.v.). For the next century the ecclesiastical affairs of Scotland were in a state of turbulent confusion. In 1610 a general assembly meeting at Glasgow restored the episcopal system to the Scottish church. Twenty-eight years later, in an atmosphere of national rebellion against the attempt of Charles I to ban extemporaneous prayer in the Church of Scotland and substitute a semi-Catholic liturgy (q.v.), the general assembly rescinded the anti-Presbyterian legislation of six previous assemblies, condemned and deposed the bishops, and abolished episcopacy.

In 1642 occurred the first phase of the civil war in Great Britain traditionally referred to as the Great Rebellion (q.v.), which involved among other issues the conflict between Anglicans and Roman Catholics on the one hand and Presbyterians on the other. The following year a body of English and Scottish Presbyterian clergymen, known as the Westminster Assembly, or Assembly of Divines, was appointed by the anti-Royalist Long Parliament (q.v.) to formulate comprehensively the doctrine and polity of the Church of England (q.v.). The result of their deliberations, the Westminster Standards, comprising the Westminster Confession and the Westminster Catechisms, contains a clear and authoritative exposition of Calvinist theology and Presbyterian church government. In 1661, following the abolition of the Commonwealth (q.v.) and Protectorate established by Oliver Cromwell (see under CROMWELL) and the restoration of Charles II to the British throne, the Scottish parliament passed a General Act Recisory, abrogating all parliamentary acts for the preceding twenty-eight years and thereby automatically reestablishing episcopacy in the Church of Scotland. After the Glorious Revolution of 1688, however, which deposed the autocratic Catholic monarch James II (James VII of Scotland), and the accession to the British throne of the Protestant William of Orange (see WILLIAM III) and his wife, Mary (see MARY II), civil and religious liberty was restored and Presbyterianism revived. In 1701 the Act of Settlement was passed, one provision of which was the exclusion of Roman Catholics from the British throne; prelacy was done away with, and the Westminster Standards were adopted. See SETTLEMENT, ACT OF.

Formation of the Modern Church. The question of patronage was a source of dissension at an early period, for the Scots claimed the right to elect their own clergy, or at least the privilege

of vetoing an unsatisfactory appointment. A worldly spirit manifested itself, men lax in principle obtained important ecclesiastical posts, and irregular doctrines were advanced; the result was the secession from the established Scottish church of various protesting groups. The first party to withdraw were the Cameronians (q.v.), moderate Calvinists originally led by the Scottish Covenanter Richard Cameron (q.v.). They seceded in 1681, refusing to accept the changes in ecclesiastical polity instituted by Charles II. The Cameronians were organized as the Reformed Presbytery in 1743, their ecclesiastical establishment later becoming known as the Reformed Presbyterian Church of Scotland. Another dissident body, under the leadership of the deposed Scottish Presbyterian clergyman Ebenezer Erskine (1680–1754), appeared in 1733 as the Associate Presbytery. It underwent reorganization in 1745 as the Associate Synod and again in 1842 as the Synod of United Original Seceders. Most of the members of this denomination became affiliated in 1852 with the Free Church of Scotland (q.v.); but an uncompromising minority maintained its separate identity under the original name until 1956, when this synod was reunited with the Church of Scotland. A third group, calling itself the Relief Presbytery (subsequently the Relief Synod), separated from the Auld Kirk in 1761 to obtain "relief" from the alleged abuses of the patronage system. In 1847 the Relief Synod entered into a union with the United Secession, a coalition of seceding denominations, the combined establishment being thereafter known as the United Presbyterian Church of Scotland. The Free Presbyterian Church of Scotland was organized in 1893 by a small percentage of the members of the Free Church of Scotland who refused to abide by the Free Church's Declaratory Act, allowing a measure of freedom in the interpretation of minor laws of ecclesiastical government. In 1900 the Free Church and the United Presbyterian Church were merged to form the United Free Church of Scotland, which twenty-nine years later was joined to the Church of Scotland. In the early 1970's the church had some 2060 congregations and a membership of about 1,110,000.

See also CHRISTIAN CHURCH, HISTORY OF THE.

SCOTLAND YARD, popular name for the headquarters of the Metropolitan Police Force of London, England. The name was derived from a small area in which the headquarters were situated from 1829 to 1890. The area, in turn, was named after a palace in which the Scottish kings of the Middle Ages resided during their visits to

SCOTT

London. The custom of referring to the headquarters and its officers as Scotland Yard began soon after the Metropolitan Police Force was reorganized by the British statesman, Sir Robert Peel (q.v.) in 1829. The headquarters were moved in 1890 to new buildings erected on the Thames Embankment, which are known as New Scotland Yard. With the completion of an extension building in 1945, the headquarters became known as New Scotland Yard North, New Scotland Yard South, and New Scotland Yard Central. The headquarters extend to several other buildings in the area, and within its jurisdiction are a series of local police stations and a number of police agencies and branches.

SCOTT, Dred. See DRED SCOTT CASE.

SCOTT, Duncan Campbell (1862–1947), Canadian poet and writer, born in Ottawa, Ontario Province. Of Scottish and English parentage, he was educated at Stanstead College and served from 1879 until 1932 in Canada's department of Indian Affairs, of which he was the director at the time of his retirement. He co-edited over a number of years a historical-biographical series of publications called "The Makers of Canada." Scott's poetry and prose reflect his knowledge of Indian life and his travels in the Canadian wilderness, and emphasize the heroic conflict of man and nature. His published collections of poetry include *The Magic House and Other Poems* (1893), *Labor and the Angel* (1898), *Lundy's Lane* (1916), *Beauty of Life* (1921), *The Green Cloister* (1935), and *The Circle of Affection* (1947). His short stories are collected in *In the Village of Viger* (1896) and *The Witching of Elspie* (1923).

SCOTT, Robert Falcon (1868–1912), British naval officer and antarctic explorer, born in Devonport, England. He entered the Royal Navy at the age of fourteen. In 1900 he was placed in command of the National Antarctic Expedition. Scott left England in 1901 and established a land base on the shores of McMurdo Sound, in Antarctica. He explored to the east of the Ross Shelf Ice and named Edward VII Peninsula. He also led a party that achieved a record latitude of 82°17' S. and sledged over Victoria Land. The expedition, which returned in 1904, was responsible for scientific discoveries of marked importance.

In 1910, Scott embarked on a second antarctic expedition, with the aim of being the first man to reach the South Pole. He again landed at McMurdo Sound, and with four companions began a trek of 1842 mi., the longest continuous sledge journey ever made in the polar regions. Scott reached the South Pole on Jan. 18, 1912,

only to find the tent and flag of the Norwegian explorer Roald Amundsen (q.v.), who had achieved the goal five weeks earlier. The return journey ended in the loss of the entire party. Petty Officer Edgar Evans (d. 1912) died from a fall; Captain Lawrence Oates (1880–1912) sacrificed his life, hoping thus to save his comrades; Henry R. Bowers (1883–1912), Dr. Edward Wilson (1872–1912), and Scott perished of starvation and exposure on March 29, 1912, within 11 mi. of their base camp. Their bodies, together with valuable documents and specimens left by Scott in his tent, were found by a search party two weeks later. His diaries and other documents were published as *Scott's Last Expedition* in 1913. He also was the author of *The Voyage of the Discovery* (1905).

See also ANTARCTICA: *Exploration*.

SCOTT, Sir Walter (1771–1832), Scottish novelist and poet, born in Edinburgh. Scott's work as a translator, editor, biographer, and critic, joined to his fictional achievements, made him the most prominent British literary man of his age. Trained as a lawyer, he was called to the bar in 1792, and from 1799 until near his death he served as a legal official. In 1797 he married Charlotte Charpentier (1770–1826), daughter of a French refugee.

Poet and Translator. A love of ballads and legends helped direct Scott's future literary activity. His translations of German Gothic romances in 1796 gained him some note, but he first achieved eminence with his edition of ballads, *The Minstrelsy of the Scottish Border*, in 1802–03. The publication in 1805 of his first narrative poem, *The Lay of the Last Minstrel*, brought Scott huge popularity. Following this success, he wrote a series of Romantic narrative poems, which included *Marmion* (1808), *The Lady of the Lake* (1810), *The Bridal of Triermain* (1813), and *The Lord of the Isles* (1815). Among his other works during these years were editions of the writings of the English poet, dramatist, and essayist John Dryden in 1808 and of the English satirist Jonathan Swift (qq.v.) in 1814, each including a biography.

Novels. Declining popularity as a poet, in part caused by the competition of Lord Byron (q.v.), led Scott to turn to the novel. *Waverley* (1814) began a new series of triumphs. More than twenty novels followed in rapid succession. Among the most valued are *Guy Mannering* (1815), *The Antiquary* (1816), *Old Mortality* (1816), *The Heart of Midlothian* (1818), *Rob Roy* (1818), *The Bride of Lammermoor* (1819), *Ivanhoe* (1820), *Kenilworth* (1821), *Quentin Durward* (1823), *St. Ronan's Well* (1824), *Redgaun-*



Sir Walter Scott

tlet (1824), and *The Fair Maid of Perth* (1828). Although he published his fiction anonymously until late in his career, the identity of "The Great Unknown," as the author of the *Waverley* novels was called, became an open secret. Scott used his enormous profits to construct a baronial mansion called Abbotsford (q.v.), which became an international landmark. In 1820 he was made a baronet, the first person to be so honored solely for literary achievements.

Entanglements with the printing firm of James Ballantyne (1772–1833) and the publishing house of Archibald Constable (1774–1827) led to a severe change in Scott's fortunes. Both failed in the economic crisis of 1826. Refusing the easy recourse of bankruptcy, Scott determined to pay a debt of more than £120,000 and strove heroically at this task for the rest of his life. He completed the *Life of Napoleon Buonaparte* (1827), wrote several new novels, and annotated a new edition of his works. Weakened by a series of strokes, he traveled on the Continent for his health in 1831, but he died shortly after his return to Abbotsford, on Sept. 21, 1832. By the sale of copyrights, all Scott's debts were settled by 1847.

Evaluation. Scott is the first major historical novelist. In his portraits of Scotland, England, and the Continent from medieval times to the 18th century, he showed a keen sense of political and traditional forces and of their influence

on the individual. Although his plots are sometimes hastily constructed and his characters sometimes stilted, these works remain valuable for their clear understanding of human nature, their compelling atmosphere, and their occasional epic dignity. Scott's influence has been immeasurable. The novelists James Fenimore Cooper in America, Honoré de Balzac in France, and Charles Dickens and William Makepeace Thackeray (q.v.) in England were among the many who learned from his panoramic studies of the interplay between social trends and individual character. In Great Britain, he created an interest in Scottish traditions which has remained till this day, and throughout the Western world, he encouraged the cult of the Middle Ages which strongly marked the artistic movement known as Romanticism (q.v.).

See SCOTTISH LANGUAGE AND LITERATURE: 19th and 20th Centuries.

M.G.S.

SCOTT, Winfield (1786–1866), American army officer, born near Petersburg, Va. He studied law until 1808, when he joined the United States Army and received a commission as captain of light artillery. At the beginning of the War of 1812 (q.v.) with Great Britain, Scott was appointed a lieutenant colonel and sent to the Canadian frontier. He led his regiment in the Battle of Queenston Heights on Oct. 13, 1812, in which the American forces were repulsed with heavy losses, and Scott was taken prisoner. He was exchanged a year later. In 1814 Scott, now a brigadier general, led his brigade to victory in the battles of Chippewa, on July 5, and Lundy's Lane (see LUNDY'S LANE, BATTLE OF), on July 23. His military successes made him a national hero, and he was brevetted a major general.

In 1832 President Andrew Jackson (q.v.) appointed Scott military guardian of Federal authority during the nullification (q.v.) controversy in South Carolina. He was also a major influence in 1839 in the pacification of the North American Indian tribe of the Cherokee (q.v.), who refused to give up their eastern lands. In 1841 Scott was appointed general in chief of the U.S. Army, and in 1847, after the beginning of the Mexican War (q.v.), he was appointed commander of the United States forces in Mexico. He led his troops in a series of victories, at Vera Cruz, Cerro Gordo, and Chapultepec. On Sept. 14, 1847, he entered Mexico City and occupied the national palace. Scott returned to the U.S. in 1848, and in 1852 Congress revived the brevet rank of lieutenant general for him. In the same year he was nominated by the Whig Party (q.v.) for the Presidency, but was overwhelmingly defeated. He retired in 1861.

SCOTTISH DEERHOUND

SCOTTISH DEERHOUND. See DEERHOUND, SCOTTISH.

SCOTTISH LANGUAGE AND LITERATURE, language and literature of Scotland, the country occupying the northern part of the island of Great Britain. The language of medieval Scotland, outside the Gaelic-speaking areas, was originally a northern form of English identical with that spoken in northern England; see GAELIC LANGUAGE. As the various peoples of Scotland coalesced into a Scottish nation with Scots and Gaelic as their two major languages, a distinctive Scottish literary tradition developed.

15th to 18th Centuries. By the 15th century the Scottish language had entered the phase known as Middle Scots, in the course of which a highly complex and extremely versatile literary language was developed by Scottish poets. Among these were James I, King of Scotland, the probable author of *The King's Quair* (1423), an accomplished poem which brings a direct autobiographical element into the tradition of love allegory; Robert Henryson (1430?–1506?), author of the delicately ironic fables in *The Moral Fables of Aesop the Phrygian* and *The Testament of Cresseid*, the latter a beautifully handled sequel to *Troilus and Criseyde* (1382–86) by the English poet Geoffrey Chaucer; William Dunbar, foremost of the Middle Scots poets, best known for his poem *The Lament for the Makaris*, *makaris* being the word for poets; and Gawin Douglas, whose translation of the *Aeneid* is a European achievement. Sir David Lindsay was a versatile traditional poet whose long moral-allegorical play *Ane Satyre of the Thrie Estaitis* ("A Satire of the Three Estates", 1540) was a unique achievement in Scottish drama. The tradition of the Middle Scots poets continued to the beginning of the 17th century in the work of the court poets Alexander Scott (1525?–84?) and Alexander Montgomerie (1556?–1610?).

Other poets, however, were looking toward England. William Drummond of Hawthornden (1585–1649), for example, wrote love poetry in imitation of Elizabethan English, with no Scottish elements at all. In 1603 the union of the crowns of Scotland and England occurred. James VI, King of Scotland, went south to become James I, King of Great Britain, taking with him his court poets. Finally, the political union of England and Scotland in 1707 combined with the effects of the Reformation to ring the death knell of an independent Scottish literary language. Scottish writers increasingly wrote in English, though they long continued to speak Scots, which, deprived of literary exercise, degenerated into regional dialects.

Scots prose developed late and is found mostly in translations and histories. The most interesting Scots prose work of the 16th century is the anonymous *Complaynt of Scotland* (1594). The *History of the Reformation* (completed in 1564) by the religious reformer John Knox, uses an Anglicized Scots and points to the influence of English Bible translations on the native Scots prose tradition.

The loss of Scotland's independence as a separate kingdom encouraged a compensating literary revival in the 18th century, notably a revival of poetry in what had now become the vernacular and a spate of song writing and ballad imitation. Allan Ramsay, editor, antiquarian, poet, and songwriter, was a pioneer of ballad poetry. Robert Fergusson (1750–74) wrote vivid Scots poems of Edinburgh life and influenced the most famous Scottish poet of the age, Robert Burns. The songs, verse letters, descriptive and most of all satirical poems of Burns exemplify this 18th-century revival.

19th and 20th Centuries. Scottish poetry in the 19th century was largely sentimental dialect verse. The achievement of Sir Walter Scott in creating the historical novel and using a vigorous spoken Scots in dialogue, however, helped to preserve a spoken Scots in literature, as did the novels of John Galt. Scottish poetry and fiction of the 19th century belonged in most part to the Kailyard school, which produced nostalgic and sentimental works describing the life and manners of Scotland. The best known of these works is *A Window in Thrums* (1889), a series of tales about the city of Kirriemuir by James Matthew Barrie. The Kailyard tradition was struck a powerful blow by the savagely realistic novel of Scottish life, *The House with the Green Shutters* (1901), by George Douglas (pen name of George Douglas Brown; 1869–1902). Robert Louis Stevenson had made his own contribution to the Scottish topographical novel in *Kidnapped* (1886), and he also wrote some poems in Scots.

The Scottish literary Renaissance of the 20th century, led by the poet Hugh MacDiarmid (pen name of Christopher Murray Grieve; 1892–1978); has revived a literary Scots, now called Lallans, by deliberately synthesizing elements from modern regional dialects and older Scottish poets. As a spoken language, modern Scots survives mainly in the form of regional dialects in rural areas. D.D.

Gaelic Literature. Until the 15th century Scottish literature in Gaelic was identical with Irish Gaelic literature. The first significant differentiation appears in the poetry anthology the *Book*

of the *Dean of Lismore*, containing work by the bard Fionnlagh Ruadh. It was not until the seventeenth century that Scottish Gaelic literature assumed a firm identity in such works as the *Black and Red Books of Clanranald* and the *Fernaigh* manuscript compiled by Duncan Macrae. The first important work in a tradition of nature poetry was *Aiseiridh na Sean Chánoin* (1751). As in Ireland, the eighteenth century saw the flourishing of Gaelic poetry. There have been attempts at revivals but none to equal the intensity of this period.

See separate biographies for persons whose birth and death dates are not given. D.D.

SCOTTISH TERRIER, type of terrier, the forerunner of which originated in Scotland several centuries ago, but which in its present form was not bred until the middle of the 19th century, when it was developed in England and Scotland; see **TERRIER**. The Scottish terrier is used to ferret out foxes and other small game, and is also highly popular as a pet. The dog has a long skull, slightly rounded at the top; small, almond-shaped eyes, dark brown or nearly black in color and set wide apart; small, upstanding or prick ears; a thick and muscular neck; a broad and deep chest; short legs; and a tail about 7 in. long, carried jauntily. The coat is about 2 in. in depth and consists of a dense undercoat and a hard, wiry outer coat. In color the Scottish terrier is black, iron gray or steel gray, wheaten, or sandy. The dog is about 10 in. high at the shoulder and weighs about 19 lb.

SCOTTSBLUFF, city of Nebraska, in Scotts Bluff Co., on the North Platte R., about 400 miles N.W. of Omaha. A processing and marketing area, the city has dairying, canning, and sugar-processing plants. Major crops in the area include beans and sugar beets. The city is on the Oregon Trail (q.v.), and nearby is the Oregon Trail Museum. Pop. (1960) 13,377; (1970) 14,507.

SCOTTS BLUFF NATIONAL MONUMENT, area of historic interest in W. Nebraska, on the North Platte R., in Scotts Bluff County, near Gering, preserving a tall bluff that was a famous landmark on the old Oregon Trail (q.v.). The bluff, named for Hiram Scott, a fur trapper who died nearby about 1828, rises 800 ft. above the river, or 4649 ft. above sea level. The monument includes a museum containing paintings of frontier history and dioramas depicting buffalo hunts. It is administered by the National Park Service (q.v.).

SCOTTSBORO CASE, legal case developing from the arrest, on March 9, 1931, of nine Negro boys, in Scottsboro, Ala., for the alleged rape of two white girls. The following month, although



Scottish terrier

Walter Chandoha

the evidence against them consisted largely of the testimony of the girls involved, one of whom subsequently recanted, eight of the boys were sentenced to death and the ninth, only thirteen years old, to life imprisonment. Many Americans, including such eminent lawyers as Clarence Seward Darrow (q.v.), considered the verdict unfounded and brought about by racial bias; civic organizations supported the Scottsboro boys, as they came to be called, and their case became an international *cause célèbre*. After six years of appeals and retrials, during which the Supreme Court of the United States twice declared mistrials, five of the original indictments were dropped. The remaining four men received long prison terms. Heywood Patterson (about 1913–52), regarded by the prosecution as the leader of the group, drew seventy-five years. By 1946 all were paroled except Patterson, who, two years later, escaped to Michigan, where the State government refused to extradite him to Alabama. Patterson was the coauthor of *Scottsboro Boy* (1950).

SCOTTSDALE, city of Arizona, in Maricopa Co., 10 miles N.E. of downtown Phoenix. Traversed by the Arizona Canal, it lies W. of the Salt River Indian Reservation. Lettuce, citrus fruits, grain, and cotton are grown in the area. The city produces electrical and electronic equipment, apparel, ceramics, and bricks. A resort and a leading art center, Scottsdale styles itself "the West's Most Western Town". Nearby to the N. is Taliesin West, former winter home of the American architect Frank Lloyd Wright (q.v.), now a school of architecture. Developed about 1900, Scottsdale became a town in 1913 and a city in 1951. Pop. (1960) 10,026; (1970) 67,823.

SCOTUS, Duns. See **DUNS SCOTUS, JOHN**.

SCOUTS. See **BOY SCOUTS**; **BOY SCOUTS OF AMERICA**; **GIRL SCOUTS OF THE UNITED STATES OF AMERICA**.

SCRANTON, city in Pennsylvania, and county seat of Lackawanna Co., on the Lackawanna R.,

SCRANTON

about 125 miles N.W. of Philadelphia. It is the center and distributing point for the anthracite-coal region of N.E. Pennsylvania. The mining of anthracite coal in and around the city is the principal industry. Scranton is also the center of an important silk-manufacturing district and is the site of one of the largest Nottingham lace mills in the world. Other industries include the manufacture of metals, electrical machinery, food products, leather goods, color television tubes, and apparel. Among educational and cultural institutions of the city are the University of Scranton (Roman Catholic), founded in 1888; extension schools of the University of Pennsylvania and Pennsylvania State University; Marywood College (Roman Catholic), founded in 1915; the Pennsylvania State Oral School for the Deaf, founded in 1882; the Scranton Philharmonic Orchestra; the Scranton Opera Guild; and the Everhart Museum of Natural History, Science, and Art, noted for its collections of birds and reptiles and of anthracite fossils. In the city are twenty-six municipal parks and playgrounds, covering about 247 acres.

History. The site of Scranton was settled about 1786 when two brothers named Abbott established a sawmill here. The settlement was known successively as Unionville, Slocum Hollow, and Scrantonia. In 1840 the American manufacturer George Whitefield Scranton (1811–61) and his brother established an iron forge in Slocum Hollow, and in 1851 the community received its present name. Scranton was incorporated as a borough in 1853 and, after annexing several adjacent communities, was chartered

as a city in 1866. Pop. (1960) 111,443; (1970) 103,564.

SCREW, mechanical fastening device consisting essentially of an inclined plane (q.v.) wound spirally around a cylinder. The ridges formed by the winding planes are called threads, and depending on the intended use, the threads may be square, triangular or rounded in cross-section. The distance between two corresponding points on adjacent threads is called the pitch. If the thread is on the outside of a cylinder, it is called a screw or male thread, and if it is on the inside of a cylinder, as in the case of a common nut, it is called a female screw. Screws and bolts used in machines employ a cylindrical shaft with a constant inner or minor diameter, but wood screws and pipe threads are cut on a tapering cone.

The use of the screw as a simple device realizes the mechanical advantage of the inclined plane. This advantage is increased by the leverage usually applied to the turning of the cylinder, and it is decreased by the high frictional losses in a screw-type system. Because of the high frictional forces, screws can be used as fastening devices, and in systems which require a high mechanical advantage with only one driving member. The latter system is illustrated by the conventional worm gear (screw) and pinion arrangement familiar in automobile-steering systems (see **GEARING**), in which rotation of the worm can move the pinion back and forth, but friction forces prevent the pinion from moving and turning the worm; see **FRICTION**. Similarly, friction forces prevent a screw jack, such as is used for jacking up an automobile, from slipping. The screw can also provide carefully controlled forward and backward motion relative to a connected machine member, as in a micrometer, which can measure distances to within 1/10,000 of an inch. The controlled motion is also used in various types of machine tools, such as lathes, where the cutting tools can be advanced uniformly. The principle of the screw is also used in conveyors, in certain types of pumps, and in ship and airplane propellers, which cut through the water or the air in a screwlike fashion; see **PROPELLER**. F.L.

SCREW PINE, common name applied to any plant of the genus *Pandanus* and to certain plants of the related genus *Freycinetia*. The genus *Pandanus* is typical of the Screw-Pine family Pandanaceae, belonging to the monocotyledonous Screw-Pine order, Pandanales. The order is of worldwide distribution, and is characterized by reduced, unisexual flowers borne in tight spikes or heads, and by ovules

Screw pine, genus Pandanus

Diamon Smithers –
National Audubon Society



with fleshy or mealy endosperm. It also includes the Cattail family, Typhaceae, and the Bur-Reed family, Sparganiaceae. The family Pandanaceae comprises three genera, *Pandanus*, *Freycinetia*, and *Sararanya*. Plants in the family have rigid leaves and small dioecious flowers; the fruits of *Pandanus* and *Sararanya* are drupes, while those of *Freycinetia* are berries.

SCREWWORM. See ENTOMOLOGY, MEDICAL: *Methods of Control*.

SCRIABIN, Alexander or **SCRIABINE, Alexander** (Russ. *Aleksandr Nikolaevich Skryabin*) (1872–1915), Russian composer and pianist, born in Moscow, and trained at the Moscow Conservatory. He taught piano at the Moscow Conservatory from 1898 to 1903, after which he devoted himself to composition and to concert tours as a pianist performing his own works. He toured in the United States in 1906–07.

Scriabin, greatly influenced by theosophy (q.v.), envisioned a new art form that would synthesize all the arts in the service of religion. He attempted to prove the relationship between tone and color by inventing a special instrument, the *clavier à lumières*, or color keyboard, which would project on a screen colors supposedly corresponding to the musical tones produced by the orchestra or pianist. This instrument was never built, and in performances of his orchestral tone poem *Prometheus*, also known as *The Poem of Fire* (1910), simple color slides were used. In this work and many others, Scriabin abandoned traditional harmony in favor of a system of his own based on a "mystic" chord built entirely on intervals of a fourth: C-F -B -E-A-D; see INTERVAL. His music is characterized by great rhythmic complexity and melodies marked by upward skips. He composed many piano works, including ten sonatas, and several large orchestral works, among them his third symphony, *The Divine Poem* (1903), and his fourth symphony, *The Poem of Ecstasy* (1907–08).

SCRIBE (Lat. *scribere*, "to write"), in antiquity, men who acted not only as copyists but as editors and interpreters of the Bible and of the law. Among the Jews, a scribe (Heb. *sopher*) originally was a copyist of the law or a secretary but eventually became an official roughly equivalent to a town clerk or sometimes a secretary of state. The scribe was a literary man preoccupied with the letter of the law and was learned in scripture. The scribes of the Pharisees and the Sadducees (qq.v.) represented different and often opposing interpretations of the laws of Judaism (q.v.). In the 1st century A.D. the scribes were the preservers of Judaism after the de-

struction of the Temple; see PALESTINE: *History*. Among the Greeks, the scribes also began as copyists (Gr. *grammateus*) and became expounders of the law (Gr. *nomodidaskalos*). English versions of the New Testament used the word "scribe" to translate both the Hebrew *sopher* and the Greek *grammateus*.

SCRIBE, Augustin Eugène (1791–1861), French dramatist, born in Paris, and educated at the Collège de Sainte-Barbe. Although none of his plays achieved the status of a classic, he enjoyed great popularity in his time, producing about 350 plays and opera librettos, most of which were written with collaborators. He was judged to be lacking in taste and original ideas but was acknowledged as a master craftsman. His best-known plays include *Le Verre d'Eau* ("The Glass of Water", 1840), *Une Chaîne* ("A Chain", 1842), and *Adrienne Lecouvreur* (1849), which was a vehicle for the famous French actress Rachel (1820–58). Among the operas for which Scribe wrote all or part of the librettos are *Fra Diavolo* ("Brother Satan", 1830), music by the French composer Daniel François Esprit Auber (1782–1871), and *Les Huguenots* (1836), music by the German composer Giacomo Meyerbeer (q.v.). Scribe was elected to the French Academy in 1834.

SCRIPPS, Edward Wyllis (1854–1926), American newspaper publisher, born in Rushville, Ill. In 1872 he served on the staff of the *Detroit Tribune*, and in 1873 of the *Detroit Evening News*, which was owned by his half brother James Edmund Scripps (1835–1906). In 1878 he founded and became the editor of the *Cleveland Penny Press*, later the *Press*. He became the proprietor of the *Saint Louis Chronicle* in 1880 and the *Cincinnati Penny Post* in 1882. In 1895, in partnership with the American newspaper publisher Milton Alexander McRae (1858–1930), he organized the newspaper chain known as the Scripps-McRae League of Newspapers. This organization later became the Scripps-Howard newspaper chain and reached the second largest total circulation in the United States; see HOWARD, ROY WILSON; NEWSPAPERS: *United States Newspapers*. Also in partnership with McRae, Edward Scripps organized in 1897 the Scripps-McRae Press Association, which in 1907 became the United Press. In 1902 he originated modern syndicated matter by starting the Newspaper Enterprise Association to supply cartoons and feature articles to papers in his chain. Scripps also established a number of agencies for scientific research, including the Scripps Foundation for Population Research at Miami University, Oxford, Ohio, and the Scripps Institution of

Oceanography (q.v.) at La Jolla, Calif. He retired from active newspaper work in 1920 in favor of his son, Robert Paine Scripps (1895–1938).

SCRIPPS INSTITUTION OF OCEANOGRAPHY, oceanographic research institution in La Jolla, Calif. It is part of the University of California at San Diego. The institution was established in 1903 as an independent biological research laboratory and became part of the University of California in 1912. In recognition of the financial support given the institution by members of the Scripps family (see **SCRIPPS, EDWARD WYLLIS**), it was renamed Scripps Institution for Biological Research. The present name dates from 1925. The institution operates eight oceanographic research vessels. Its research programs include biological, physical, chemical, geological, and geophysical studies of the oceans. Doctoral degrees are offered in many of these areas of study.

SCROFULA, or **KING'S EVIL**, diseased body condition characterized by enlargement and cheesy degeneration of the lymph nodes, especially in the neck. The term "scrofula" has held different meanings at various periods in medical history and generally was used interchangeably with the terms "tuberculous" and "strumous"; today scrofula is used for a specific manifestation of tuberculosis (q.v.), caused by the tuberculosis bacillus, and usually spreading to the skin, bones, and joints much in the manner of other forms of tuberculosis. The term "king's evil" was applied to this condition in the Middle Ages because of a belief that scrofula could be cured by the touch of a king's hand.

SCROPHULARIACEAE, family, commonly called the figwort family, of usually perennial plants in the order Polemoniales. It contains about 200 genera and 2500 species, mostly herbs and shrubs, widely distributed in temperate zones throughout the world. The plants are characterized by flowers having a four- or five-lobed calyx, two-lipped corolla, four stamens, and a solitary pistil. The fruit is a loculicidal capsule. The principal genera include *Gerardia*, purple gerardia; *Antirrhinum*, snapdragon; *Digitalis*, foxglove; *Mimulus*, musk or monkey flower; *Pentstemon*, beardtongue; the typical genus *Scrophularia*, figwort; and *Veronica*, speedwell. Other important genera are *Verbascum*, mullein, having woolly leaves; *Calceolaria*, cultivated for its pouch-shaped flowers; and the root parasites *Castilleja*, painted cup, and *Pedicularis*, lousewort, anciently reputed to draw lice to the animals which ate it. The typical genus, *Scrophularia*, is characterized by small flowers borne in a terminal cluster; the corolla has four

erect lobes and one spreading, liplike lobe. See separate articles under common names of most of plants mentioned.

SCUBA DIVING. See **DIVING**: *Diving Suits*; **SKIN DIVING**.

SCUDÉRY, Magdeleine de or **SCUDÉRI, Magdeleine de**, often known as **SAPHO** (1607–1701), French novelist, born in Le Havre. She established a fashionable literary salon in Paris and became an extremely successful writer. Her principal works were lengthy sentimental novels, such as *Artamène, ou le Grand Cyrus* ("Artamene, or Cyrus the Great", 10 vol., 1649–53) and *Clélie, Histoire Romaine* ("Clelie, Roman Tale," 10 vol., 1654–60), written in the elaborate style that characterized the movement toward refinement in literature known as preciosity; see **FRENCH LITERATURE**: *The Classic Period in French Literature*. Several of her novels were published in collaboration with her brother, the writer Georges de Scudéry (1601–67).

SCULPTURE, art of carving or shaping hard or plastic materials to create three-dimensional representations of natural and imagined objects or to create three-dimensional abstract forms. Sculpture has been practiced throughout the world in all civilizations from prehistoric times to the present day. The two principal types are free-standing sculpture in the round, and sculpture in relief, in which the designs are carved or modeled upon a flat surface, or attached to a solid surface or background. In all ages the chief subject of sculpture has been the human figure.

Materials and Techniques. The materials most often employed in sculpture are clay, wood, stone, and metal; wax, plaster, ivory, bone, and precious and semiprecious stones are also frequently used. Plastic materials, such as clay, wax, and plaster, are modeled or shaped either with the hands alone or with the aid of modeling tools and spatulas. Clay sculpture, baked to permanent hardness in a kiln (q.v.), is known as terra-cotta and has been a major sculptural material since ancient times.

Wood, stone, and other hard substances are carved directly with chisels and are also often worked with rasps, saws, sandpaper, and drills to vary the surface finish of the carved material. The surfaces are preserved usually by oiling or waxing. A small-scale preliminary model in wax, clay, or plaster is frequently used as a guide to the execution of the finished work. Direct carving in stone was largely supplanted in Europe and the United States during the 19th century by a mechanical process, known as pointing, in which the forms of a plaster cast made from an original clay sculpture are duplicated or en-



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Above, left: "Miroku Bosatsu", or "The Compassionate One", Japanese bronze of the 7th-century Suiko period. Above, right: Head of a Greek athlete. Right: "Mother and Child", Indian sculpture of the 11th century. Below, left: Limestone relief from Egypt of the Coptic period, about the 5th century. The woman represents Holy Wisdom. Below, right: "Kneeling Shepherd", early 16th-century wood statue by Master Paul of Levoča, from the Church of Saint James, in Levoča, Czechoslovakia.



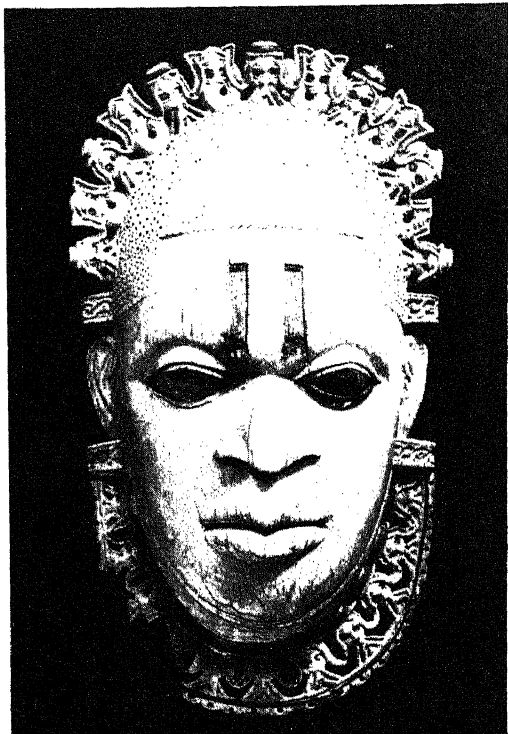
Govt. of India Tourist Office



Brooklyn Museum



Pierre de Mentionner



Museum of Primitive Art



Tate Gallery, London

Above, left: African sculpture. Mask of elephant ivory with iron and copper inlay, from the 16th-century kingdom of Benin. Above, right: "Family Group" by Henry Moore. The influence of primitive sculpture on modern art is shown by the similar styles of (below, left) a pre-Columbian ceremonial bird costume (600-900) from Veracruz, Mexico, and (below, right) "Little Monkey", 1961, a metal cutout by Pablo Picasso.

Andre Emmerich Inc.

Museum of Modern Art - Collection of the artist



larged in a stone version of the work by means of a measuring machine and a process of drilling and chiseling. In this method, trained stonemasons execute a sculptor's work in stone, the sculptor himself adding only the finishing touches. At the end of the 19th century and the beginning of the 20th century, many sculptors abandoned the use of pointing in favor of a return to direct carving.

Sculpture in metal may be cast by pouring molten metal into a mold of the design. Molds are made usually of a fine, close-packing composite of clay, silica, and alumina, known as French sand, or the casting may be done by means of the lost-wax process; see **FOUNDING: Modern Founding Methods**. Metal can be shaped by hammering thin plates into the desired forms. Bronze is the most common material for casting, but gold, silver, lead, iron, tin, and many other metals are also used. In hammered-metal sculpture, thin plates of copper, bronze, lead, or precious metal are embossed by hammering; this method is often used for colossal statues as well as for small decorative objects; see **METALWORK**.

Within recent years many new materials and methods have been adopted for sculpture. In welded sculpture, metal plates and rods and such objects as plows, bolts, and frying pans are used. Steel, chromium, and synthetic plastics are other materials employed especially for sculpture in abstract, or nonrepresentational, forms. A notable recent extension of the field of sculpture has been the development of abstract sculptural works in wire. These experimental works are antithetical to the traditional conception of sculpture as massive and static; they are composed of wires and rods holding in suspension flat metal shapes. The mobile (q.v.) is another popular modern extension of sculpture.

See separate articles on most of the sculptural materials mentioned.

History. The earliest-known sculptures, small-scale human figures and animals carved in ivory, bone, or horn, and animals modeled in clay, were executed in the Aurignacian and Magdalenian phases of the prehistoric Old Stone Age or Paleolithic Period (unknown duration, ending about 8000 B.C.); see **IVORY CARVING**. The sculpture of the various cultures in historic times, from antiquity to the present day, is treated in separate articles. For discussions of the sculpture of antiquity, see **AEGEAN CIVILIZATION**; **ASSYRIAN ART**; **BABYLONIAN ART**; **EGYPTIAN ARCHITECTURE AND ART**; **ETRURIA**; **GREEK ART AND ARCHITECTURE**; **PHOENICIAN ART AND ARCHITECTURE**. For discussions of medieval sculpture, see **BYZANTINE ART**; **CHRISTIAN ART**,

EARLY; GOTHIC ART; **ROMANESQUE ART AND ARCHITECTURE**. Renaissance and modern sculpture are discussed in articles such as **ABSTRACT AND NON-OBJECTIVE ART**; **FLEMISH ART AND ARCHITECTURE**; **FRENCH ART AND ARCHITECTURE**; **GERMAN ART AND ARCHITECTURE**; **ITALIAN ART AND ARCHITECTURE**; **RENAISSANCE ART AND ARCHITECTURE**. The sculpture of non-European cultures is discussed in articles such as **AFRICAN ART**; **CHINESE ART**; **INDIAN ART AND ARCHITECTURE**; **ISLAMIC ART AND ARCHITECTURE**; **JAPANESE ART AND ARCHITECTURE**; **MAYA**; **PERSIAN ART AND ARCHITECTURE**; **PERUVIAN ARCHEOLOGY**. See also individual biographies of famous sculptors.

SCURVY, disease of human beings caused by a prolonged deficiency of Vitamin C, or ascorbic acid, in the diet (see **VITAMIN**). When affecting infants, it is known as Barlow's disease. It is characterized by progressive bodily weakness, spongy and inflamed gums, loose teeth, swollen and tender joints, and a tendency toward ecchymosis, or absorption by the tissues of blood from ruptured blood vessels. Anemia (q.v.) often occurs as a result of such hemorrhage. The symptoms of scurvy are caused by a lack of Vitamin C intake that results in the adsorption and decreased production by the body of the intercellular material that supports the fibrous tissues and forms the cement substance of capillaries, bone, dentin, and cartilage. In the United States, the disease occurs today primarily among bottle-fed infants; in such cases scurvy attacks particularly the bones, and is characterized externally by swelling and tenderness of the legs, irritability, pallor, and great weakness. The disease may appear in adults after about six months of complete lack of Vitamin C; it takes a longer time to develop when the diet contains a small but inadequate amount of Vitamin C.

Scurvy has been known since antiquity. It became prevalent when sailors began to spend months at sea without fresh vegetables and in such cases was usually fatal. In 1795, lime juice was issued to all British naval vessels on the recommendation of the Scottish physician, James Lind (1716–94), who knew that the Dutch had employed citrus fruits for several hundred years; with the issuance of lime juice to British merchant ships in 1865, scurvy began to disappear among British seamen. A specific deficiency of Vitamin C was later recognized as the cause of this disease; oranges and lemons, which have a higher Vitamin-C content than limes, have supplanted limes as antiscorbutic agents; pediatricians advise orange juice for bottle-fed infants.

SCUTARI. See **SHKODËR**.

SCYLLA AND CHARYBDIS, in Greek mythology, two sea monsters dwelling on the opposite

SCYTHIA

sides of a narrow strait, the personification of the dangers of navigation near the rocks and eddies. Scylla, a horrible creature with twelve feet and six long necks, each bearing a head with three rows of teeth, with which she devoured any prey that came within reach, lived in a cave on a precipitous cliff. Across the strait opposite her was a large fig tree under which Charybdis, the whirlpool, dwelt, sucking in and belching forth the waters of the sea three times daily, engulfing anything that came near. When the Greek hero Odysseus (see ULYSSES) passed between them, he was able to avoid Charybdis, but Scylla seized six men from the ship and devoured them. In later times, the geographical position of this dangerous passage was believed to be the Strait of Messina between Italy and Sicily, with Scylla on the Italian side. Scylla was originally a beautiful maiden loved by a sea-god. Her jealous rival, the sorceress Circe (q.v.), transformed her into a monster.

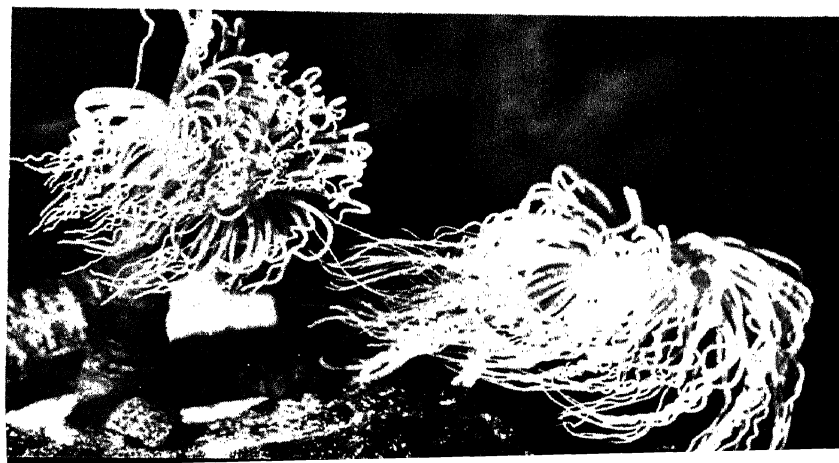
SCYTHIA, name given by the ancient Greeks after about 800 B.C. to the homeland of the Scythians (q.v.) in the s.e. part of Europe, eastward from the Carpathian Mts. to the Don R.; this region was seized by the Sarmatians (q.v.) in the 4th century B.C. and became known as Sarmatia. The name Scythia was sometimes applied by ancient geographers to the greater part of s.e. Europe and central Asia, from the Danube R. to the mountains of Turkestan.

SCYTHIANS, name given by ancient Greek writers to a number of nomadic tribes of southeastern Europe and Asia, and used either for the Scythians proper, or Scolots, dwelling north of the Black Sea, between the Carpathian Mts. and the Don R.; or for all the nomad tribes who inhabited the steppes eastward from what is now Hungary to the mountains of Turkestan. The tribes are believed to have migrated to these areas from the region of the Altay Mts., on the border of China, during the 8th century B.C.

Their speech was a form of Iranian, one of the branches of the Indo-European languages (q.v.). Scythians kept herds of horses, cattle, and sheep, lived in tent-covered wagons, and fought with bows and arrows on horseback. They developed a rich culture characterized by opulent tombs, fine metal work, and a brilliant art style. In the early 7th century B.C. the Scythians advanced south of the Caspian Sea and invaded the kingdom of Media (q.v.), but they were expelled in 625 by Cyaxares, King of Media (d. about 585 B.C.). Shortly after the middle of the 4th century B.C. the Scythians of southeastern Europe were subdued and largely exterminated by the Sarmatians (q.v.), who then gave their name to the region. The Scythian tribes in Asia, however, invaded the Parthian Empire (see PARTHIA), southeast of the Caspian Sea, in the 2nd century B.C. About 130 B.C. they advanced eastward into the kingdom of Bactria (q.v.), in the region of present-day Afghanistan, and in the 1st century B.C. they invaded western and northern India, where they remained a powerful entity for five centuries; see AFGHANISTAN: *History*; INDIA: *History*.

SEA, general designation for all the salt water in all the specific oceans and seas that cover a large area of the surface of the earth; see OCEAN AND OCEANOGRAPHY. The name is particularly given to bodies of salt water like the Mediterranean Sea (q.v.) that are partially landlocked and are smaller than the ocean to which they are generally connected. The name is also used to designate inland bodies of salt water, such as the Caspian Sea (q.v.), and has occasionally been given to inland bodies of fresh water, such as the Sea of Galilee; see TIBERIAS, LAKE OF.

SEA ANEMONE, common name for any of the marine flowerlike polyps in the class Anthozoa. These coelenterates have a cylindrical, or vase-like, body (see COELENTERATA). The body is closed and attached to rocks or piles at one end and, at



Sea anemone

Arthur W. Ambler -
National Audubon Society

the other end, has a central mouth surrounded by tentacles armed with nematocysts (sting cells and thread cells that paralyze and entangle the small fish and marine animals that constitute its prey). The mouth opens into a short esophagus opening into the body cavity. At each end of the slitlike mouth a permanent pore opens into a ciliated groove, called a siphonoglyph, in the side of the gullet, through which a continuous current of water flows, carrying oxygen to the tissues and removing waste matter. The body cavity is divided into a number of sacs by septa extending from the body wall. These septa increase the surface available for the secretion of digestive juices and the absorption of nourishment, and contain the gonads that produce the sperm and eggs. Sexual reproduction is the rule, budding and fission being comparatively rare. The eggs are usually fertilized in the gastric cavity, and the young are discharged from the mouth as free-swimming larvae, which soon attach themselves to rocks or piling. Some forms attach themselves to the shells of hermit crabs (see COMMENSALISM); others become completely parasitical in certain species of jellyfish (q.v.). Many species of sea anemones are colored; large specimens may attain a diameter of 36 in.

SEA BASS, common name for any fish of the family Serranidae, which consists of about 400 species of carnivorous, perchlike fishes, abounding in all warm seas and in some fresh waters and sometimes includes the grouper (q.v.). They have oblong, laterally compressed bodies, covered with ctenoid scales with comblike or sawlike margins. Members of the family are powerful swimmers and leapers, and are generally regarded as excellent food fish. The black sea bass, *Centropomus striatus*, is common along the entire coast, especially between Cape Cod and the mouth of Chesapeake Bay. It is dusky brown or black, more or less mottled, and has pale longitudinal streaks. Occasionally it reaches a length of 18 in. and a weight of 4 lb. On the Pacific coast the name is applied to the white sea bass, *Atractoscion nobilis*, and to the giant jewfish, *Stereolepis gigas*; specimens of the latter have been found which weigh as much as 800 lb. See Bass.

SEABEES, popular name for the volunteer construction battalions of the United States Navy organized during World War II (q.v.) to supplement the construction work of the U.S. naval engineers. The name is a verbalization of the initials "c.b." (construction battalion), as well as reflecting naval ("sea") identity and effective work ("bee"). The Seabees replaced civilian employees in various engineering duties in areas

beyond the continental limits of the U.S. They were particularly active in the Pacific theater of war and gained a reputation for their hard work and bravery in clearing and building operations while under enemy attack. The personnel of the Seabees were recruited from highly trained civilian specialists in the construction trades. All Seabee recruits were given an intensive military training course. After World War II, the personnel of Seabees were retained by the Navy as part of its peace-time establishment.

SEABORG, Glenn Theodore (1912–), American chemist, born in Ishpeming, Mich. He was educated at the University of California and taught chemistry at the university after 1939, becoming an assistant professor in 1941 and a full professor in 1945. He was chairman of the Atomic Energy Commission (q.v.), 1961–71 and then became professor at the University of California, Berkeley, and associate director of the Lawrence Berkeley Laboratory. From 1942 to 1946, on leave from the University of California, he was on the staff of the Metallurgical Laboratory at the University of Chicago, conducting research in nuclear chemistry and physics in connection with the atomic-energy project; see NUCLEAR ENERGY. He is particularly known for his discovery and characterization of many radioactive isotopes (see ISOTOPE) and for his share in the discovery of such elements as plutonium, americium, curium, berkelium, californium, einsteinium, fermium, mendelevium, and nobelium; see TRANSURANIUM ELEMENTS. Seaborg shared the 1951 Nobel Prize in chemistry with the American physicist Edwin Mattison McMillan (q.v.). His writings include *Nuclear Properties of the Heavy Elements* (1964) and *Nuclear Milestones* (1972).

SEABURY, Samuel (1873–1958), American jurist, born in New York City, and educated at the New York Law School. He was a justice of the New York State Supreme Court (1906–14) and associate justice of the New York State Court of Appeals (1914–16). He resigned from the latter post to accept the Democratic nomination for the governorship of New York, but was defeated in the 1916 election. Seabury again came to prominence in 1930, when he was appointed to investigate charges of corruption in the magistrate courts of New York City. In the following year Franklin Delano Roosevelt (q.v.), then governor of New York, named Seabury to investigate the government of New York City. This investigation resulted in disclosures of corruption that led to the resignation of Mayor James John Walker (q.v.) and to the defeat in 1933 of the Democratic Party candidate by the Fusionist candidate Fiorello Henry La Guardia (q.v.). Sea-

SEA COW

bury was elected president of the New York Law Institute in 1937. He is the author of *New Federalism* (1950).

SEA COW. See MANATEE.

SEA CUCUMBER. See HOLOTHURIOIDEA.

SEA GULL, generally any gull (q.v.) found near coastal water. See also BIRD: *Classification: Divisions of Classification*.

SEA HORSE, any of a number of small fishes of the Pipefish family, which constitute the genus *Hippocampus* and its near allies and take their name from the resemblance of the head to that of a horse. It is a syngnathous fish, having long, tubular jaws much like a snout. The body is compressed, with an elongated tail, and the integument is a series of large, rectangular bony plates, with a series of spines and projections along the lines of juncture. These spines, together with the divided, streamerlike fins of some species, give them a strong resemblance to the seaweeds among which they live. About twenty-four species are found in various warm and temperate seas. All keep near the shore, often developing in brackish water. Like the pipefishes, the males take charge of the eggs, which are placed in an abdominal pouch and remain there until they hatch. The common sea horse, *H. hudsonius*, of the Atlantic coast of North America is one of the largest species, reaching a length of over 5 in.

SEA ISLANDS, group of low, sandy or marshy islands of the s.e. United States, in the Atlantic Ocean, off the coasts of Florida, Georgia, and South Carolina. The most important islands are Saint Helena, Port Royal, and Parris, off South Carolina, Jekyll and Saint Simons, off Georgia, and Amelia, off Florida. The principal industries on the islands are fishing, agriculture, and tourism; Parris Island is a United States Marine Corps training base.

SEAL, common name for any of the marine carnivorous mammals of the order Pinnipedia.

The various forms, known also as fur seals, hair seals, elephant seals, sea lions, and leopard seals, are widely distributed throughout the marine regions of the Frigid and Temperate zones, only the monk seals of the genus *Monachus* being tropical. Three families of seals exist, the Otariidae, or eared seals, the Odobenidae, consisting of the single species of walrus (q.v.), and the Phocidae, or true seals. All three families represent a reversion to aquatic habitat from ancestral land dwellers; they have become almost perfectly adapted to life in the water, and resort to shores or ice floes only for purposes of breeding and rearing their young. Seals eat fish, shell fish, and other marine animals.

EARED SEALS

The eared seals, which have long, flexible necks, comprise two groups, the sea lions and the fur seals, or sea bears.

Sea Lions. The sea lions are the largest of the eared seals. Steller's sea lion, *Eumetopias jubata*, is found in the North Pacific Ocean. Adult males attain a length of 12 ft. and a maximum weight of 2000 lb.; females are much smaller, weighing up to 800 lb. The southern sea lion, *Otaria byronia*, a smaller species, is found on the coasts of South America. The seal frequently trained for exhibition in circuses and zoos is the small California sea lion, *Zalophus californianus*, found off the California coast.

Fur Seals. Of great commercial importance, the fur seals closely resemble the sea lions anatomically but differ in having a rich, silky undercoat of fur (q.v.). Two genera are recognized, *Arctocephalus* of the Southern Hemisphere, and *Callorhinus* of the North Pacific Ocean and the Bering Sea. Six species of the southern fur seal are recognized, of which the best-known is *A. pusillus* of the southern coast of Africa. Other species occur off southern New Zealand, southern Australia and Tasmania, South America, and Guadalupe Island.

Harp seals, *Pagophilus groenlandica* UPI





California sea lions, *Zalophus californianus*

UPI

The single northern species is the northern fur seal, *C. ursinus*, which breeds in the Pribilof Islands of the Bering Sea. The male, or bull, is mostly dark brown in color, shading to gray at the shoulders. After reaching maturity at about the age of seven years, the bull attains a length of 6 ft. and a weight of 500 lb., the female, or cow, that matures at three years, is lighter in color and attains an average weight of 80 lb. Each bull has a harem of as many as forty cows. Because an equal number of male and female pups are born, most males do not mate; bulls which successfully conquer a harem hold it by battle against all unmated males until defeated. Immature and bachelor males and old bulls congregate on beaches removed from the breeding grounds. As winter approaches the fur seals migrate southward to the latitudes of Baja California.

In the late-19th century, the indiscriminate slaughter at sea of the migrating herds for their valuable fur led to a sharp decline in the fur-seal population. In 1911 an international treaty, adopted by the United States, Great Britain, Russia, and Japan, established effective controls for the preservation of the species. Pelagic sealing, or the hunting of seals in the ocean, was prohibited by the agreement, which permitted capture only of immature or bachelor seals, taken at the outskirts of the breeding grounds under government supervision. When the treaty went into effect the Pribilof herd numbered about 200,000. A revised treaty was signed in 1957, making the Pribilof Islands a special government reservation. Under protection the herd has increased to an estimated population of al-

most 2,000,000 and comprises about 85 percent of the fur seals of the world. See also **BERING SEA CONTROVERSY**.

For a discussion of seals belonging to the family Odobenidae, see **WALRUS**.

TRUE SEALS

Numerous species make up the Phocidae, or true seals, and include the hair seal or harbor seal, the ringed seal, the ribbon seal, the harp seal, the bearded seal, the crab-eater seal, Ross's seal, the Weddell seal, and the gray seal. Other members of the group are the hooded seal, monk seal, elephant seal, and leopard seal. In the Phocidae the external ear is lacking, the neck is short and relatively inflexible, and the forelimbs, although undeveloped, bear claws which are useful in landing on rocks and ice floes. The hind limbs cannot be flexed forward like those of the eared seals and are moved vertically when used in swimming. Better adapted to life in the water than the eared seals, the Phocidae are less adapted to locomotion on shore, progressing mostly by wriggling the entire body.

Among the Phocidae, many species are hunted principally for their skins, which are used for leather (q.v.). The harbor seal, *Phoca vitulina*, of the northern oceans is 3 to 6 ft. in length, and is usually yellowish white with brown markings. The species *Pusa caspica*, of the Caspian Sea, and *Pusa siberica*, of Lake Baikal, are smaller, but are considered an important catch. The harp seal, *Pagophilus groenlandicus*, is slightly larger, reaching a length of 6 to 7 ft. It is extremely gregarious, and is found in great

SEAL

numbers during the breeding season on the ice floes northward from Newfoundland. The ringed seal or floe rat, *Pusa hispida*, is also arctic in distribution, and is about the same size as the harp seal. The gray seal, *Halichoerus grypus*, and the hooded seal, *Cystophora cristata*, are larger, and are also found in arctic waters. The monk seal, *Monachus monachus*, is found in the Mediterranean and Black seas, and another species is found in the Hawaiian Islands; *M. tropicalis*, a species of monk seal in the Caribbean, may now be extinct.

Elephant seals are so called for trunklike proboscis and their great size. They were once numerous, but the oil obtained from their blubber was found to be of high commercial value, and they were hunted almost to extinction. Survivors of large herds of two species are still extant. *Mirounga angustirostris*, once common in the waters of southern California, attains a length of 22 ft., and a single animal has yielded as much as 200 gal. of oil. A similar species, *M. leonina*, formerly found in most regions of the Southern Hemisphere, still exists on South Georgia Island and some other areas in the South Atlantic Ocean. The antarctic seals include the leopard seal, *Hydrurga leptonyx*, and Weddell's seal, *Leptonychotes weddellii*, both of which are gray mottled or spotted with brown. I.T.S. & K.A.C. **SEAL**, impression on wax or other soft substance made from a die or matrix of metal, a gem, or some other material. The stamp that yields the impression is itself sometimes called the seal. In Egypt seals were in use at an early period, the matrix generally forming part of a ring. The emperors, after the time of Constantine I (q.v.), introduced a leaden seal called bulla.

Ecclesiastical seals first appeared in the 9th century and attained great beauty in the 13th and 14th centuries. These devices possess a pointed-oval form known as vesica piscis and have for subjects a bishop, sometimes the Trinity, the Virgin, or a patron saint, seated under an elaborate architectural canopy. Seals came into general use in England after the Norman conquest of 1066. The earliest regular Great Seal of England is that of Edward the Confessor (see *under* EDWARD), impressions of which still exist.

In the United States, seals on various legal documents and the kind of seals required are almost wholly regulated by statutes.

See GREAT SEAL OF THE UNITED STATES.

SEA LAW. See MARITIME LAW.

SEA LEVEL, mean level of the surface of the sea, midway between the levels of high and low water caused by tidal fluctuations; see TIDES.

This standard value is generally used to measure relative differences in height of geographical features above sea level and depth below sea level. Thus, the height of Mt. Everest is expressed as 29,028 ft. above sea level, and the surface of the Dead Sea, situated between Israel and Jordan, at about 1300 ft. below sea level. In meteorology and physics (qq.v.), atmospheric pressure is expressed as 760 mm (29.92 in.) of mercury, or 14.7 lb. per sq.in. at 32° F. (0° C.); see ATMOSPHERE; PRESSURE.

SEA LILY. See CRINOIDEA.

SEA LION. See SEAL.

SEALYHAM TERRIER, variety of terrier developed by the hunter and breeder Captain John Tucker-Edwards on his estate Sealyham, at Ha-verfordwest, Wales, between 1850 and 1891; see TERRIER. The breeds from which the sealyham originated are not precisely known. The dog was imported into the United States in 1911 and has become highly popular in this country. The Sealyham, noted for its courage and endurance, is used for ferreting out of cover such animals as the fox, otter, and badger, and is also a general favorite as a pet. The dog has a long head, with a wide skull slightly rounded at the top; oval-shaped, dark eyes, set deep and wide apart and very alert in expression; a muscular neck; short legs, the forelegs straight and heavily boned, the hindlegs longer than the forelegs; powerful hindquarters; and a docked tail carried upright. The animal has a soft, dense undercoat and a wiry outer coat that resists water and cold. The color of the dog is white; the head and ears of some specimens have markings or streaks of tan or lemon color. The Sealyham Terrier is about 10 in. high at the withers; the male weighs about 21 lb., the female, 20 lb.

SEAMAN, Elizabeth Cochrane. See BLY, NELLIE.

SEA OTTER, common name applied to an otter (q.v.), *Enhydra lutris*, native to the American and Asian shores of the North Pacific Ocean, which comprises the genus *Enhydra* of the family Mustelidae. Similar in appearance and in aquatic habits to the Eurasian and North American otters of the genus *Lutra*, it is of sturdy build and reaches a length of about 4 ft. Sea otters feed mainly on mollusks and sea urchins, which they crush with their large, blunt teeth. The female gives birth to a single offspring at a time, which she nurses while lying on her back in the water. The pelt of the sea otter furnishes one of the most highly prized of all furs. The brown inner fur is soft, dense, and woolly, and is overlaid by the coarser and longer gray-tipped hairs of the outer fur. Once very abundant, the animals had been hunted to such

an extent that they were almost extinct during the first half of the 20th century. Protective measures were adopted, and there are now considerable numbers of sea otters in the coastal waters of California and, especially, Alaska.

SEA PARROT. See PUFFIN.

SEAPLANE. See AIRPLANE; AVIATION; CURTISS, GLENN HAMMOND.

SEARCH, RIGHT OF, in wartime the right of a belligerent warship to stop neutral merchant vessels on the high seas in order to ascertain the nature of the cargo and the ownership of the vessel and thus determine its liability to capture. A belligerent in time of war has the right to capture the property of an enemy at sea and to seize so-called contraband of war (q.v.). The right of search is regulated by international treaty.

According to current codes, the belligerent vessel must first make known its identity, notifying the neutral vessel of its intent to visit and search, usually by firing a gun. The neutral ship must then hoist its flag and stop. If the belligerent vessel encounters force or concealment in making its search, it may use force. If the search discloses facts that justify seizure of the vessel as a prize, the belligerent vessel need exercise only reasonable care in taking the prize into port. The claim by the British government of the right to search American vessels for deserters was a factor contributing to the outbreak of the War of 1812; see IMPRESSMENT. The so-called navicert system established during World War I, requires that ships of neutral countries carry identification certificates issued by representatives of the belligerent countries, the presentation of which would establish their neutrality and preclude the necessity for a search. The use of submarines and airplanes and the difficulties encountered in searching a large vessel made exercise of the right of search impractical at sea during World Wars I and II. As a result the Allies adopted the practice of ordering all neutral vessels to proceed to an Allied port for search. See also NEUTRALITY.

Peacetime Search. In time of peace, ships of a state may stop and search foreign vessels on the high seas (q.v.) to the extent that it may be necessary in order to enforce its rights of limited jurisdiction and control beyond its territorial waters (q.v.). These rights include that of establishing and maintaining "contiguous zones" for the prevention and punishment of violations of national customs, fiscal, immigration, and sanitary regulations. Such zones extend to a distance of up to 12 mi. from its coast. A state also may establish and maintain exclu-

sive fishery zones up to the same distance and regulate the exploration and exploitation of the natural resources of the continental shelf adjacent to the national coast. It may prevent and punish piracy and practice of the slave trade. And it may also, under certain special treaties, provide for the protection of submarine cables. **SEARCH WARRANT,** in criminal law in England and the United States, order of a court, usually of a magistrate, issued to an officer of the law authorizing him to search the premises named in the warrant for stolen articles, property possessed in violation of the law, or the instruments or evidence of a crime. The warrant authorizes the officer to seize particularly described items and to bring them before the court that issued the warrant. At common law (q.v.), search warrants were used principally to discover stolen property, but by modern law their use has been extended to a variety of items, including intoxicating liquors, gambling implements, counterfeiters' tools, burglars' tools, smuggled goods, obscene literature, narcotics, illegal firearms; in general, any article the possession of which is a crime or which may be used in evidence.

Under the Fourth Amendment of the Constitution of the United States (q.v.) a search warrant can be issued only on oath of a complainant showing probable cause for its issuance. The warrant must specify definitely the place in which the search is to be made and the property to be seized. An officer who, in executing the warrant, does not comply with or exceeds its terms is liable civilly for all acts not authorized by it; an action to recover damages may be instituted against him for trespass or assault (qq.v.), or both. In addition, items seized under an illegally issued or executed warrant may not be used in evidence in a criminal trial.

See also EVIDENCE.

G.R.B.

SEA ROBIN, common name for any of several gurnards of the family Triglidae, found off the coast of North and South America, Europe, and Africa, and characterized by brightly colored markings on the body or fins and casquelike heads usually armed with spines. A common sea robin of the North Atlantic coast of the United States is *Prionotus carolinus*.

See GURNARD.

SEA SERPENT, imaginary marine creature supposed to be of snakelike form and of monstrous size. During the times of wooden sailing vessels, sea serpents were widely believed to be the agents of destruction of many ships. No scientific evidence as yet supports the existence of snakelike sea monsters. Exaggerated descrip-

SEAS, FREEDOM OF THE

tions of the sea snake (q.v.) or of the oarfishes have probably been responsible for most reports of sea serpents; floating seaweeds have probably also contributed to this myth. Such a monster has also been reputed to exist in the waters of Loch Ness (q.v.), Scotland.

SEAS, FREEDOM OF THE, in international law (q.v.), right of all nations to navigate and fish freely on the high seas (q.v.), without molestation by any nation in time of peace. This right, however, is subject to the rights of belligerents to search neutral vessels for contraband of war, unneutral service, and break of blockade (q.v.) of enemy ports in time of war. See **BELLIGERENT**; **NEUTRALITY**; **SEARCH, RIGHT OF**.

History. During the Middle Ages freedom of navigation on the high seas was curtailed by maritime powers that asserted territorial sovereignty over various bodies of water. Challenges by other countries to such claims increased markedly during the 16th and 17th centuries, largely because of the growth in world trade following the discovery, exploration, and colonization of new lands. The legal basis for claims of territorial sovereignty over the high seas was dealt a severe blow by the Dutch jurist Hugo Grotius (q.v.), regarded as the father of international law. Grotius on the basis of Roman legal principle, contended in his *Mare Liberum* (1609) that the seas cannot constitute property because they cannot be occupied in the sense in which land can be occupied and that they are therefore free to all nations and subject to none. In the 18th century the Dutch jurist Cornelis van Bynkershoek (1673–1743) formulated the important principle of international law that the waters adjoining the shores of a country within the range of artillery on land are not included in the juridical meaning of the term “high seas” but are under the territorial sovereignty of the contiguous country. This principle was subsequently adopted throughout the world. A distance of 3 mi. was generally accepted, but this limit was challenged in the 20th century, many countries claiming a limit of 6 or even 12 mi.

In the late 18th century attempts to curtail free navigation on the high seas were made by such powers as Great Britain, which in time of war sought to stop all trade of other nations with its enemies. A notable example of the assumption of such rights was the blockade by the British of western European ports during the Napoleonic Wars (q.v.). Another was the molestation by the British of American shipping on the high seas, an act that was a contributing factor to causing the War of 1812 (q.v.) between Great Britain and the United States.

Controversy over the conflicting rights of neutrals and belligerents occupied a prominent place in international affairs throughout the 19th century and the first decade of the 20th century. The Declaration of Paris of 1856, signed during the Crimean War (q.v.) by Great Britain and France and later accepted by most other powers, increased freedom of the seas for neutrals. The Declaration of London of 1909 resulted from an international naval conference attempting to resolve certain questions regarding trade and contraband raised at the second Hague Conference; however, although it further defined neutral rights, it was never ratified. See **LONDON, DECLARATION OF**; **SEARCH, RIGHT OF**.

20th Century Developments. During World War I (q.v.) the use of submarines and aircraft demonstrated the inadequacy of international law with respect to freedom of the seas. Virtually all laws and treaties relating to the subject were disregarded as Great Britain strove to blockade the European continent and Germany attempted to isolate the British from the rest of the world. Interference by Germany in American trade with Great Britain was one of the causes of the entry of the U.S. into the war in 1917. In the following year President Woodrow Wilson (q.v.), of the U.S., included as one of the fourteen points (q.v.) he projected as a basis for ending the war: “Absolute freedom of navigation upon the seas, outside territorial waters, alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants”. The Covenant of the League of Nations (q.v.) required all members to embargo trade with countries found to be guilty of aggression (Article 16). The application of the article was considered in a number of cases, especially the Japanese invasion of Manchuria and the Italian invasion of Ethiopia (qq.v.).

During World War II (q.v.) the rights of neutrals were largely disregarded by the belligerent powers because of the desperate urgency of both sides to utilize every means of achieving victory and of the global character of the war. The Charter of the United Nations (q.v.), in 1945, included a provision similar to that in the League’s Covenant empowering the Security Council (q.v.) to institute, among other measures, partial or total interruptions of sea communications, including blockades, when necessary to maintain or restore international peace or security (Article 42).

The U.N. Conference on the Law of the Sea, convened in Geneva in 1958, defined rights of navigation and fishery on the high seas in time

of peace. Despite protracted discussion and compromise attempts, however, differences over the question of 3-mi., 6-mi., or 12-mi. territorial-water limits remained unresolved. The conference approved articles defining the continental shelf (see CONTINENT) and innocent passage of foreign ships through territorial waters and straits. Innocent passage was defined as maritime transit that "is not prejudicial to the peace, good order, or security of the coastal State".

The continuing disagreement over the width of territorial waters, however, posed new threats to the freedom of the seas. In 1952 Ecuador, Peru, and Brazil extended their claims to 200 mi. and seized many U.S. and other foreign ships engaged in fishing without their permission. Several other nations in various parts of the world also began to extend their offshore zones well beyond 12 mi. to exercise control over their fish stocks, commercial catches, and other natural resources. The increasing number and intensity of international disputes resulting from such unilateral actions, as well as other maritime problems such as rights to the exploitation of newly discovered minerals in the deeper seabed, induced the United Nations to call another Law of the Sea conference in 1973. In March, 1977, with the conference still in session, the U.S. extended its fishing zone to 200 mi., limiting fishing within that area to nations that extended reciprocal rights to U.S. fleets. Following this action, many major nations established similar 200-mi. zones, reaching fishing agreements with other countries by direct negotiation. Ordinary navigation, however, was not restricted in these fishing zones.

See TERRITORIAL WATERS. Q.W. & C.J.L.

SEASICKNESS. See MOTION SICKNESS.

SEASIDE, city of California, in Monterey Co., on the s. shore of Monterey Bay, about 5 miles E. of Monterey. Seaside is noted for its bulbs and flower seeds. Apples, pears, and apricots are grown and patent medicines and concrete products are manufactured. Nearby are clam and crab fisheries and Fort Ord, an army base. Founded about 1900, Seaside was incorporated in 1954. Pop. (1960) 19,353; (1970) 35,935.

SEA SNAKE, common name applied to any of numerous aquatic, mostly ovoviviparous, poisonous snakes belonging to the family Hydrophiidae. With the exception of one species, sea snakes inhabit the tropical waters ranging from the Persian Gulf to the southwest Pacific Ocean, and are particularly abundant in the Indian Ocean and the Bay of Bengal. They are usually 4 to 5 ft. in length but some species attain a

length of 8 to 9 ft. The paddlelike tail is wide and compressed and is an effective swimming organ. Most species never leave the water and do not have the enlarged abdominal scales of terrestrial snakes. Sea snakes are not equipped with gills and rise frequently to the surface of the water for air. They are able to remain under water for several hours, however, obtaining dissolved oxygen from water which they swallow and eject. They feed on elongate fishes, such as eels, which they paralyze with their poisonous venom, but do not attack humans unless they are kept in restraint. The largest genus is *Hydrophis* which contains about two dozen species. Members of the genus *Laticauda*, which are found in the eastern Indian Ocean and western Pacific, have broad abdominal scales and spend part of their time crawling on marshy areas. The yellow-bellied sea snake, *Pelamydrus platurus*, is found off the coast of southern California and northern South America as well as in the waters more commonly inhabited by sea snakes. The lower half of the eel-like body is yellow and the upper half is black or dark brown. It is usually less than 3 ft. long. The term "sea snake" is sometimes applied to the mythical sea serpent (q.v.).

SEASONS. See ECLIPTIC.

SEATO. See SOUTHEAST ASIA TREATY ORGANIZATION.

SEA TROUT. See TROUT; WEAKFISH.

SEATTLE, city in Washington, and county seat of King Co., between Elliott Bay, an arm of Puget Sound, on the W. and Lake Washington on the E., 140 miles S. of the Canadian border, 965 mi. by water N. of San Francisco, and 2200 mi. by rail W. of Chicago. It is served by Seattle-Tacoma International Airport, by transcontinental railroad, and by numerous transoceanic steamship lines as well as the so-called mosquito fleet of steamers serving Puget Sound ports. The fine landlocked harbor comprises outer and inner harbors connected by the Lake Washington Ship Canal, which passes through the heart of the city. The deep saltwater, or outer, harbor on Puget Sound has a maximum width of 5 mi. Lake Washington, the freshwater, or inner, harbor, is 27 mi. long and 4 mi. wide. It is crossed by the largest concrete pontoon bridge in the world. Large vessels pass the bridge through a floating drawspan. The ship canal, 8 mi. long and 150 ft. wide, with a depth of 36 ft., can accommodate ships up to 760 ft. long. A series of locks, with a maximum depth of 42 ft., facilitates the passage of ships from the level of Puget Sound to that of Lake Washington. The total waterfront area of Seattle harbor is 193 mi., of which 53

SEATTLE

mi. are on tidewater and 140 mi. on freshwater.

The city of Seattle, covering an area of 104.41 sq.mi., is built on a series of hills rising to an elevation of 520 ft. above sea level. The city is noted for its spectacular views and scenery. Two lakes, Lake Union and Green Lake, lie within its limits. On the western horizon rise the Olympic Mts., to the east are the Cascades, to the north is Mt. Baker (10,778 ft.), and to the south is Mt. Rainier (14,410 ft.). Business and manufacturing establishments occupy sites near the waterfront. Notable buildings in this area include the 52-story Seattle First National Bank Building and the 42-story, tower-crowned L. C. Smith Building. The residential districts crown the hills, which include Queen Anne, Beacon, Capitol, First, Madrona, and Renton hills. Seattle Center, the 74-acre grounds of the Century 21 World's Fair (1962), contains an opera house, a theater, a coliseum, two exhibit halls, and the 605-ft. Space Needle. The park system of Seattle covers more than 2500 acres; a notable unit is Woodland Park Zoo. A boulevard system of more than 30 mi. connects parks and other areas within the city limits. The Lake Washington Boulevard Drive, encircling the lake, is 52 mi. long. Seattle is the site of a U.S. Navy air station; a naval supply depot; Fort Lawton, a United States Army post; Boeing Field, a United States Air Force base; and a U.S. immigration detention station. Seattle is governed under the mayoral system.

Culture. Educational institutions in Seattle include the University of Washington (see WASHINGTON, UNIVERSITY OF); Seattle University (1891; Roman Catholic); Seattle Pacific College (1891; Free Methodist); and Shoreline Community College (1964; junior). Cultural facilities include the Henry Art Gallery, which contains exhibits of European and American paintings; the Washington State Museum, a museum of natural history; the Seattle Art Museum, with permanent collections of art from India, China, and Japan;

the Frye Art Museum; the Burke Memorial Museum; the Museum of History and Industry; and the Pacific Science Center. The Seattle Center buildings are headquarters for the municipal symphony orchestra, opera company, and repertory theater, and for the Seattle SuperSonics team of the National Basketball Association.

Commerce and Industry. Seattle is the largest city in population in the State, the fourth ranking port on the Pacific coast in tonnage handled, and the commercial, financial, and manufacturing center of the Pacific Northwest. It is headquarters of the Washington customs district. The city is the nearest U.S. port to the Orient, the nearest important U.S. city to Alaska, and the chief port and supply point of the North Pacific fishing and whaling industry. Waterfront facilities include docks capable of berthing 120 oceangoing vessels at one time, warehouses, grain elevators, cold-storage plants, and storage tanks for vegetable oil and fuel oil. The principal exports of Seattle are lumber products, fish, canned goods, grain, flour, livestock, dairy products, pears, apples, salt, gasoline, aluminum, scrap metal, hardware, copper, automobiles, and machinery. The chief imports are limestone, coffee, tea, sugar, rice, silk, spices, corn, bananas, hemp, rubber, furs, and vegetable oils. The city is surrounded by a region rich in timber, fisheries, minerals, and agricultural resources. Among the industrial establishments in Seattle are salmon canneries, fish-processing plants, flour mills, food canneries, lumber mills, pulp and paper mills, shipbuilding yards, foundries, and factories manufacturing airplanes, automobiles, and mining equipment. The development of the city as an industrial center has been aided by an abundance of hydroelectric power. Extensive wholesale and jobbing companies serve the vast trading area of Seattle. The city is headquarters of a branch of the 12th Federal Reserve District.



Fountains shimmer under graceful arches at the 1962 World's Fair, held in Seattle.

**Ted Bronstein—
Architectural Forum**

History. Seattle was settled in 1852 and named for the chief of a local Indian tribe. It was laid out as a town in 1853 and became the county seat in the same year. In 1869 it was incorporated as a city. With the first shipment of gold from Alaska in 1897 the city began its development as a commercial center, becoming the principal supply point and port for the gold-mining regions of Alaska and the Yukon Territory. Milestones in the city's development as a port were the arrival of the first steamship from the Orient in 1896 and the opening of the Panama Canal (q.v.) in 1914.

Population. Between 1910 and 1950 the population of Seattle increased from 237,194 to 467,591. In 1960 the population was 557,087; in 1970 it was 530,831.

SEA URCHIN. See ECHINOIDEA.

SEAWEED. See ALGAE: *Brown Algae*; KELP; RHODOPHYTA.

SEBACEOUS GLAND. See GLAND; SKIN.

SEBASTIAN, Saint (fl. 3rd cent.), Christian Roman martyr. According to tradition he was a captain of the Praetorian Guard (q.v.), and was also secretly a Christian who made many converts. When the Roman emperor Diocletian (q.v.) learned of his faith he ordered Sebastian shot to death by archers. The arrows did not kill him, however, and a Christian widow named Irene took him away and tended his wounds. As soon as he recovered Sebastian returned to the emperor and denounced him for his cruelty. Diocletian then ordered him beaten to death. The first martyrdom of Saint Sebastian was a favorite subject for Italian painters. He is often depicted with an arrow or pierced through the chest by an arrow. The saint's aid was invoked against plague (q.v.). His feast day is Jan. 20.

SEBASTIANO DEL PIOMBO, real name SEBASTIANO LUCIANI (1485?–1547), Italian painter, born in Venice. Sebastiano was invited to Rome about 1512 by the Siennese banker and art patron Agostino Chigi (1465?–1520). He there won the esteem and friendship of the Tuscan painter and sculptor Michelangelo (q.v.). The two men worked together on several paintings, including a "Pietà" (1517, Church of San Francesco, Viterbo). Most authorities believe that in several cases Michelangelo provided the drawings and Sebastiano executed the final works. Sebastiano's greatest work, "The Raising of Lazarus" (1519, London National Gallery), was also painted under the influence of Michelangelo. He was noted, as well, for portraits of contemporary cardinals and for his "Andrea Doria", a portrait of the Genoese admiral (Palazzo Doria, Rome). In 1523 Sebastiano was appointed

keeper of the papal seals by his patron Pope Clement VII (see *under* CLEMENT), thus earning his nickname *del Piombo* ("of the Seal").

SEBORRHEA, disease of the sebaceous glands, the oil glands of the skin (q.v.). Seborrhea is characterized by an increased and altered secretion of sebum, or fatty matter, and is manifested by an oily or scaly appearance of the skin, especially of the hairy parts. It may interfere with the nutrition of the hair (q.v.) and cause partial baldness. Some cases of dandruff are caused by the disease. Sebum may also accumulate in the ducts of the glands, causing the glands to become distended with undischarged sebum, and forming a small hard body called a whitehead, or comedo; when the sebum in the mouth of the duct becomes discolored with dirt, the comedo is known as a blackhead. See also ACNE.

SECANT. See TRIGONOMETRY.

SECESSION, in United States history, term applied to the withdrawal of a State from the Union. The right of secession was usually regarded by seceding States as one of their sovereign powers, there being no prohibition in this respect in the Constitution of the United States (q.v.), nor any power conferred upon the Federal government to compel a State to remain in the Union against its wishes; see STATES' RIGHTS. The legality of the concept was, however, always disputed by the Federal government.

The idea of secession appeared in New England about fifteen years after the ratification of the Constitution, in connection with the opposition of the Federalist Party to the Louisiana Purchase (qq.v.). The most famous movement for secession was in opposition to the exclusion of slavery (q.v.) from the U.S. Following the Compromise Measures of 1850 (q.v.) a group of extremists in South Carolina undertook to secure the cooperation of the slaveholding States in a movement toward secession, but at that time the plan failed. In 1860–61, however, after the election of Abraham Lincoln (q.v.) as U.S. President, eleven Southern States seceded from the Union and formed the Confederate States of America (q.v.). The act of secession was accomplished in the individual States through a convention either called by the State legislature or, as in the case of Texas, self-assembled. The defeat of the South in the Civil War was considered to have decided the question of secession in favor of the Federal government; this decision was confirmed by the Supreme Court of the United States (q.v.) in 1869. See CIVIL WAR, THE AMERICAN; UNITED STATES OF AMERICA, THE: *History: Slavery and the Preservation of the Union (1850–65)*.

SECOND

SECOND. See INTERNATIONAL SYSTEM OF UNITS; MINUTE.

SECOND ADVENT OF CHRIST, or PAROUSIA, return of Jesus Christ (q.v.) in visible form to earth. On the basis of certain sayings of Jesus the early Church expected that within a comparatively short period after the Ascension (q.v.), He would come again and usher in the full glory of the Messianic age (Matt. 24:29–31, Mark 13:24–27, Luke 21:25–28). As the years passed, many leaders of the Church came to feel that the true meaning of Jesus' words and realization of His promises were to be found in the eternal, spiritual, heavenly life rather than in a material, earthly kingdom.

In later times the doctrine of Christ's return has been held in one of two forms: the first, that it will be premillennial, that is, before the age of the great prosperity and triumph of the Church; or the second, that it will be postmillennial, after this age and immediately before the general judgment; see MILLENNIUM. The first view is based upon certain interpretations of Rev. 20:4–7, supported by other passages of Scripture, and more particularly by the general conception, believed to be derived from the Scriptures, that the present divine order does not contain in it, according to the plans of God, the means necessary to bring the world to Christ. Thus it will be necessary that Christ Himself come to rule. See ADVENTISM; ESCHATOLOGY.

SECONDARY SCHOOL. See EDUCATION IN THE UNITED STATES; EDUCATION, SECONDARY; UNITED STATES OF AMERICA: *The People: Education*. See also section on education in articles on individual countries and States of the United States.

SECOND INTERNATIONAL, or SOCIALIST INTERNATIONAL, international association of socialist and labor parties and trade unions, founded in Paris, France, in 1889 to coordinate the activities of its affiliates. Its membership consisted mainly of skilled craft and industrial workers whose allegiance to socialist ideas and aims included a primary emphasis on the improvement of their economic and political position in capitalist society through the achievement of reforms rather than by revolution. Its predecessor, the First International, known also as the International Workingmen's Association (q.v.), stressed the necessity of violent revolution and seizure by the proletariat of the means of production. Its leaders included many prominent socialists and authors of works on socialism, among them the German theorists Friedrich Engels, his former secretary Karl Johann Kautsky, and August Bebel (qq.v.), and the Russian political philosopher Georgi Valentinovich Plekhanov

(1857–1918). See CAPITALISM; COMMUNISM; REVOLUTION; SOCIALISM; THIRD INTERNATIONAL.

SECRETARIAT OF THE UNITED NATIONS, administrative organ of the United Nations (q.v.), composed of a secretary-general and "such staff as the Organization may require", according to the United Nations Charter.

The secretary-general is appointed by the General Assembly (q.v.) upon the recommendation of the Security Council (q.v.). He is the chief administrative official of the U.N. and, under Article 99 of the charter, he may bring to the attention of the Security Council any matter that in his opinion threatens international peace and security. From the very beginning of the U.N., this provision has given the secretary-general a measure of executive authority; this led, in turn, to the dissatisfaction of the Soviet Union with the first two chief officials of the U.N. The first secretary-general was Trygve Lie (q.v.) of Norway, who, under relentless Soviet pressure, was forced to resign on Nov. 10, 1952. He was succeeded by Dag Hjalmar Agne Carl Hammarskjöld (q.v.) of Sweden on April 10, 1953, who was reelected five years later. Hammarskjöld was also sharply challenged by the Soviet Union over the U.N. leadership of operations in the Democratic Republic of the Congo in 1960–61 (see UNITED NATIONS: *The Role of the United Nations in Crisis Situations: The Congo*). He died tragically in an airplane crash in the Congo on Sept. 17, 1961. On Nov. 3, the assembly appointed U Thant (q.v.) of Burma as acting secretary-general; he was then elected, and in 1966 reelected, as secretary-general. His second term expired on Dec. 31, 1971, and he was succeeded by Kurt Waldheim (1918–) of Austria.

The staff of the U.N. is appointed by the secretary-general, who selects these international civil servants partly on the basis of their competence and integrity and partly in such a way that the composition of the Secretariat reflects the geographical variety of the U.N. itself. Officials of the U.N. are responsible only to that organization; they may not seek or receive instructions from any government or authority outside of the U.N. The Secretariat is organized into various departments, including the Executive Office of the Secretary-General and offices dealing with political, legal, financial, economic, trusteeship, public information, and other matters. L.H.

SECRETARY BIRD, common name applied to a large bird of prey, *Sagittarius serpentarius*, found in Africa, south of the Sahara. It is over 3 ft. in length and has very long legs, a long tail,



Secretary bird, *Sagittarius serpentarius* Arthur W. Ambler
National Audubon Society

and a powerful, hooked beak. The secretary bird is so called because of its crest of long feathers which suggest a group of quill pens placed behind the ear of an office clerk. The general coloration of the bird is bluish gray; the primaries, thighs, and tail markings are black. It feeds on small animals and on reptiles, particularly snakes, and is frequently tamed and kept on farms in South Africa as a means of destroying vermin and reptiles. The birds build large, strong nests, low in trees or bushes to which they return every year.

SECRETION, in physiology, name applied to any process by which a gland (q.v.) separates certain substances from the blood and converts them into products used in the growth, maturation, or metabolism of the organism. The term *excretion* is applied to products elaborated primarily for the removal of waste material from the organism. Gastric juice, for example, is produced to digest food in the stomach, and is a true secretion; urine is produced by the kidneys to remove waste matters from the blood, and is an excretion. Perspiration, which has the double function of cooling the body surface and of removing certain waste matters, is both secreted and excreted. Some glands, instead of discharging their products into a duct, discharge them directly into the bloodstream; such secretions are called *hormones* (q.v.). See **ENDOCRINE SYSTEM**.

SECRET POLICE, also called **POLITICAL POLICE**. See **CHEKA**; **ESPIONAGE**: *Political Espionage*; **GESTAPO**; **G.P.U.**; **POLICE**: *National Law Enforce-*

ment; **UNION OF SOVIET SOCIALIST REPUBLICS**: *Government: Totalitarian Methods*.

SECRET SERVICE, law-enforcement agency of the United States government, under the jurisdiction of the Department of the Treasury; see **TREASURY**, **DEPARTMENT OF THE**. Created in 1865 to suppress widespread counterfeiting (q.v.) of U.S. currency, it is the oldest general law-enforcement agency of the U.S. government. The Secret Service investigates cases of counterfeiting and forgery (qq.v.), including that of U.S. Savings Bonds, and arrests any persons violating Federal laws relating to coins, obligations, and securities of the U.S. and foreign governments.

The agency is best known to the public for its role in providing personal protection to high governmental officials. Major security responsibilities of the service are: the protection of the President, members of his immediate family, the President-elect, the Vice-President, the Vice-President-elect, former Presidents and their wives, widows of former Presidents until their death or remarriage, minor children of former Presidents until they reach the age of sixteen, Presidential and Vice-Presidential candidates of the major parties, and visiting heads of foreign governments. The agency supervises the Executive Protective Service, a uniformed force which provides security for the White House and foreign diplomatic missions in Washington, D.C., and the Treasury Security Force, which provides security for the Department of the Treasury and the Treasury Annex buildings, located in the capital.

In a recent fiscal year, the service seized \$25,300,000 in counterfeit currency and arrested 1540 persons. It also investigated about 58,750 check-forgery cases, resulting in the arrest of 4450 persons, and more than 13,500 bond-forgery cases, resulting in 174 arrests.

See also **FEDERAL BUREAU OF INVESTIGATION**; **NATIONAL SECURITY COUNCIL**.

SECRET SOCIETIES, organizations in which the members are usually bound by an oath of secrecy. Secret societies often require an elaborate form of initiation and ritual use of symbols, passwords, and handgrips as a means of recognition among members.

Secret societies are common among peoples in Melanesia (q.v.) and in parts of Africa. They are also found among some Indian tribes of North America, particularly the Pueblo and the Plains Indians (qq.v.). These societies are usually organized solely for religious purposes, but in some areas, they exert a powerful force behind the economic and political life of the community.

SECUNDERABAD

Ancient Societies. In ancient Greece, the Pythagoreans combined philosophy and politics; see *PYTHAGORAS*. In the East, some Muslim sects (q.v.) were founded as secret societies, notably the Assassins (see *ASSASSIN*), who were first organized in Persia (now Iran) in the 12th century. Secret societies, usually formed for protective or political purposes, were widespread in China until the revolution of 1911; see *CHINA, PEOPLE'S REPUBLIC OF: History*.

In Europe, unorthodox religious groups, such as the early Christians (see *CHRISTIAN CHURCH, HISTORY OF THE*) or the Manichaean sects (see *MANICHAISM*), have frequently been forced to practice secrecy to avoid persecution; see *INQUISITION, THE*. During the Middle Ages members of merchant guilds (see *GUILD*) were usually bound to secrecy for economic protection; one of the largest secret societies in the world, the Freemasons (see *FREEMASONRY*), originated in the 14th century as a guild of craftsmen. During this time, also, criminal jurisdiction was sometimes exercised by such secret tribunals as the courts of the Veme, a type of vigilante organization, which became extremely powerful in Westphalia, Germany, during the 15th century.

Since the 17th Century. In the 17th and 18th centuries, secret societies were formed for scientific inquiry. Some, such as the Rosicrucian Order (q.v.), mixed science with mysticism. Secret societies also became important centers of political dissent. The organization known as the Sons of Liberty (q.v.) was created in the American colonies during the 18th century to resist British oppression. In the 19th century, revolutionary secret societies such as the Carbonari (q.v.) in Italy, the Fenians (q.v.) in Ireland, and the Nihilists (see *NIHILISM*) in Russia were important political forces. Other societies, notably the Mafia (q.v.) in Sicily, were established for the purpose of organizing criminal activities and for the protection of their members.

In the United States, some secret societies were created during the 19th and 20th centuries for protective and terrorist purposes, among them the Knights of the Golden Circle and the Ku Klux Klan (qq.v.). The principal reasons for the organization of secret societies in the U.S. and Europe during the 20th century, however, have been philanthropy and the mutual benefit of the members. In the U.S., the fraternal element has been traditionally predominant; secret organizations have also been an important feature of university life; see *FRATERNAL ORDERS; FRATERNITIES, SORORITIES, AND SOCIETIES*.

SECUNDERABAD, city of India, in Andhra Pradesh State, adjoining Hyderabad and 5 miles

n. of the city center. A major military cantonment, it is connected with Hyderabad by road and by bridge over the Husain Sagar Lake. It is the site of a branch of Osmania University. The Mushirabad Mosque is nearby. Pop. (1971) 94,416.

SECURITIES AND EXCHANGE COMMISSION, independent, quasi-judicial agency of the United States government, created by the Securities Exchange Act of 1934 and known as the S.E.C. It is generally responsible for the protection of the public and of investors against malpractices in the securities and financial markets. See *STOCK EXCHANGE*.

The S.E.C. requires the security dealer to make known in a prospectus all pertinent facts concerning new security offerings. The commission also regulates trading in securities on exchanges and in over-the-counter markets. It enforces sanctions, including the issuance of injunctions, the initiation of administrative proceedings for the suspension or revocation of brokers' licenses, and the initiation of criminal prosecutions through the United States Department of Justice against companies and persons guilty of securities frauds, manipulations, and other violations. In addition, the S.E.C. integrates and simplifies holding-company systems of electric and gas utilities; supervises the purchase and sale of securities, utility properties, and other assets by registered public-utility holding companies and their electric- and gas-utility subsidiaries; and approves their reorganizations, mergers, and consolidations. The agency also examines protective provisions in mortgage indentures under which debt securities are sold to the public; supervises the activities of closed-end investment companies, mutual funds, and investment advisers, under the Investment Company Act of 1940. In 1975 the S.E.C. ended the long-standing fixed brokerage fee, allowing fee negotiation.

The S.E.C. consists of five members, no more than three of whom may be members of the same political party. They are appointed by the President with the approval of the Senate for staggered terms of five years; one member is replaced each year. In its early years the prestige of the S.E.C. was quickly established and enhanced by a succession of strong-minded chairmen, namely the businessman and diplomat Joseph Patrick Kennedy (see *under KENNEDY*), the jurists James McCauley Landis (1899-1964) and William Orville Douglas (q.v.), and the lawyer and administrator Jerome New Frank (1889-1957). Persons aggrieved by the decisions of the S.E.C. enjoy the right of review by United States



General view of the United Nations Security Council during the voting on a resolution. United Nations

Circuit Courts of Appeals. The central office of the S.E.C. is situated in Washington, D.C.; nine regional offices are located in Atlanta, Ga.; Boston, Mass.; Chicago, Ill.; Denver, Colo.; Fort Worth, Texas; New York, N.Y.; San Francisco, Calif.; Seattle, Wash.; and Washington, D.C.

D.I.K.

SECURITY COUNCIL, one of the six principal organs of the United Nations (q.v.). It is the only U.N. organ which, under Chapter VII of the United Nations Charter, can order enforcement action, ranging from economic sanctions to military measures, in established cases of aggression or breach of peace. The Security Council has fifteen members, of which five are permanent: the United States, the U.S.S.R., Great Britain, France, and China (represented by Nationalist China until Nov. 23, 1971, when the seat was taken by the People's Republic of China). The other members are elected by the General Assembly (q.v.) to two-year terms that may not run consecutively. These seats rotate on a geographical basis; five are elected from Asia, Africa, and the Middle East; two from Western countries and two from Latin America; and one from Eastern Europe. The presidency of the council is held for a month at a time by each of the members, in English alphabetical order.

Under the U.N. Charter the Security Council bears the primary responsibility for maintaining international peace and security. Disputes and breaches of peace may be brought before it by any U.N. member nation; countries that are not members of the council, if affected by the issue at question, may be invited to participate in the discussion without vote.

Nine affirmative votes are required to pass a resolution. In procedural decisions, any nine votes suffice, but on all substantive matters the negative vote of any of the five permanent powers prevents the adoption of any resolution, whether or not nine members voted in favor. This negative vote is known as the veto right of the great powers and has been a point of controversy since the establishment of the U.N. The frequent use of the veto by the Soviet Union, especially, has given rise to repeated complaints in the U.N. In 1950, this Soviet use of the veto led to the adoption of the United for Peace resolution, which provides that the General Assembly may continue to consider a problem if the council is blocked on it by veto. Great Britain, France, and Nationalist China also used their veto rights; the U.S. cast its first veto on the issue of Rhodesia on March 17, 1970.

The Security Council also recommends to the assembly admission of new U.N. members and appointment of a new secretary-general; it participates equally with the General Assembly in electing judges to the International Court of Justice (q.v.). The council has two standing committees and a Military Staff Committee, which is not currently functioning; the council may also establish ad hoc bodies.

For the role of the Security Council in international political situations, see UNITED NATIONS: *The Role of the United Nations in Crisis Situations*. L.H.

SEDALIA, city in Missouri, and county seat of Pettis Co., 75 miles s.e. of Kansas City. Sedalia is a

SEDAN

shipping point and distributing center for the surrounding agricultural region, in which corn, oats, wheat, and other crops are produced. Industrial establishments in the city include textile mills, creameries, poultry-packing plants, and factories for the production of housewares, shoes, and chemicals. The city is the site of the Missouri State Fair, held annually in August. Sedalia was founded in 1858 and was designated as the county seat in 1864. It was chartered as a city in 1889. Pop. (1960) 23,874; (1970) 22,847.

SEDAN, town of France, in Ardennes Department, on the Meuse R., about 160 mi. N.E. of Paris. The principal manufactures are woolen textiles, chemicals, and metal products; coal and iron are mined in the vicinity. The history of Sedan dates from the 14th century, when it was an ecclesiastical dependency. In the early 15th century it became an independent principality ruled by the La Marck family, who built the great castle that still dominates the town. Sedan was made a possession of the kings of France in 1642. In 1870 it was the scene of the decisive battle of the Franco-German War (q.v.); see **SEDAN, BATTLE OF**. In World War I (q.v.) the town was captured by the Germans in August, 1914, and relieved by American troops in November, 1918. During World War II (q.v.) seventy German armored divisions defeated the French Ninth Army at Sedan in May, 1940, an action that initiated the German invasion of France. Pop. (1968) 23,000.

SEDAN, BATTLE OF, engagement fought on Sept. 1, 1870, around the town of Sedan in northern France, that decided the Franco-German War (q.v.). The battle was fought between a French army, commanded by Comte Marie Edme Patrice Maurice de MacMahon (q.v.), until he was wounded, and then by General Emmanuel Félix de Wimpffen (1811–84), and a German army under Count Helmuth von Moltke (q.v.). It resulted in a complete victory for the German forces. The French emperor Napoleon III (q.v.), who had joined the French forces in the afternoon, was also captured. The French casualties in killed and wounded were approximately 17,000; the German, about 9000. See *FRANCE: History: The Second Empire; The Third Republic to World War I*.

SEDATIVES, drugs or other remedies which allay irritability, nervous excitement, and pain, and in general exert a quieting effect on the whole body or a part of it. General sedatives include the bromides of sodium and potassium and the barbiturates, such as phenobarbital and sodium pentothal. In small doses, hypnotics,

such as chloral, and narcotics, such as opium and its derivatives, are sedative in action. General anesthetics such as ether and chloroform are used as sedatives in minimal doses, and physical applications of heat and cold, warm baths, and alcohol rubs are effective sedatives in certain nervous ailments.

Sedatives act on the body by depressing the central nervous system, beginning at the cerebral cortex (the so-called seat of consciousness) and descending to the medullary centers, which regulate certain reflexes and control respiration and the contraction and dilation of blood vessels. Sedatives relax the muscles, make the user unresponsive to physical and mental stimuli, and induce sleep. Under sedation the rate of breathing is reduced and the pulse rate and blood pressure usually decline to levels common in natural sleep. See **DRUGS, ADDICTION TO**. **SEDER**. See **PESACH**; **PRAYER, JEWISH**.

SEEDGE. See **BUIRUSH**.

SEDIMENTARY ROCKS, in geology, rocks of secondary origin, formed by the accumulation and consolidation of minerals and other materials that were originally derived from the weathering of preexisting rocks, and which were then deposited by the action of water or, less frequently, wind or glacial ice. Most sedimentary rocks are characterized by parallel layers of the various constituent rocks. The rocks are classified according to their manner of origin into mechanical and chemical sedimentary rocks. Mechanical sedimentary rocks, or fragmental rocks, are composed of mineral particles which resulted from the mechanical disintegration of other rocks, and which were transported, without chemical deterioration, by streams into a body of water; the mineral particles were then deposited in layers. Shale, sandstone (qq.v.), and conglomerate are important sedimentary rocks of mechanical origin. The materials comprising chemical sedimentary rocks were dissolved in water circulating through the parent rock formation, and were then deposited in a sea or lake by direct precipitation from solution or indirectly by marine organisms. Halite, gypsum (qq.v.), and anhydrite are formed by the evaporation of salt solutions and the consequent precipitation of the salts. Limestone (q.v.) is the most notable example of a sedimentary rock formed through the agency of marine animals. See **GEOLOGY**; **IGNEOUS ROCKS**.

SEDITION, in law, term referring to conduct directed against the state, or intending to excite disaffection with it and with those exercising authority. Such conduct generally takes the form of writing, publishing, or making speeches

inciting citizens to overthrow established governmental authority. Sedition differs from treason (q.v.) in that it does not involve overt acts of open violence or assistance to an enemy. See ALIEN AND SEDITION ACTS.

In October, 1949, eleven leaders of the Communist Party of the United States were convicted of violating the Smith Act, popularly known as the 1940 Sedition Act. The Smith Act prohibited advocacy of the violent overthrow of the U.S. government or the organization of any group promulgating such a philosophy. In *Dennis vs. United States* (1950), the Supreme Court of the United States (q.v.) upheld the constitutionality of the act, over objections based on the right of freedom of speech, by interpreting the purpose of the act to apply to a political creed that has a tendency to produce imminent lawless action. Subsequent convictions not meeting that test have been overturned, or invalidated, and the Smith Act has today fallen into disuse.

See also CONSPIRACY; SPEECH, FREEDOM OF.

SEDUM. See STONECROP.

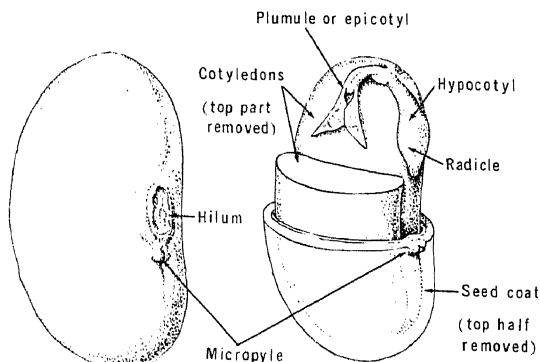
SEEBECK EFFECT. See THERMOELECTRICITY.

SEED, term applied to the ripened ovule (q.v.) of a seed plant before germination; see SPERMATOPHYTES. The seeds of angiosperms, or flowering plants, differ from the seeds of gymnosperms, or conifers and related plants, in being enclosed in the ovary which later forms a fruit (q.v.); gymnosperm seeds lie exposed on the scales of the cones.

During the process of fertilization (q.v.) the pollen tube enters the ovule through a small opening known as the micropyle. One of the two sperm nuclei in the pollen tube unites with the egg cell in the ovule to form a zygote, which develops into the embryo. In flowering plants the other sperm nucleus unites with two polar nuclei present in the embryo sac to form an endosperm nucleus which later produces the nutritive endosperm tissue surrounding the embryo in the seed. In gymnosperms the endosperm is formed from the tissue of the embryo sac itself. The nucellus of the ovule is partially digested during the development of the embryo and endosperm tissue. Surrounding the seed is a hard, tough seed coat, derived from the integument of the ovule, and known as the testa. In flowering plants a second seed coat occurs within the testa; this second coat is thin and membranous and is known as the tegmen. Some seeds, in addition, have projections from the seed coat which serve to aid in the absorption of water when the seed is about to germinate or which merely form an additional protective coating about the seed. In almost every seed,

the micropyle through which the pollen tube entered the ovule persists as a small opening in the seed coat. Close to the micropyle in flowering plants, a stalk, or funiculus, attaches the seed to the placenta on the inside of the fruit wall. When the seed is removed, a small scar, known as the hilum, marks the former attachment of the stalk.

In a few plants, such as those of the Orchid family, Orchidaceae, the embryo is a small, undifferentiated mass of cells until after the seed



Parts of Dicotyledon Seed

has parted from the parent plant; during the period between separation from the parent plant and eventual germination, the undifferentiated cells develop into an embryonic root, bud, stalk, and leaf. In most other plants this development occurs prior to seed dispersal: the embryonic root, or radicle, usually grows toward the micropyle; the embryonic bud, called plumule, or epicotyl, is at the end of the embryo opposite to the radicle; the embryonic stem, or hypocotyl, connects the radicle with the seed leaves, or cotyledons. In gymnosperms, several cotyledons are usually present; among angiosperms two great groups of plants exist, one group having but one cotyledon in the seed and known as the monocotyledons, and the other with two cotyledons, and known as dicotyledons. The cotyledons serve as centers of absorption and storage, drawing nutritive material from the endosperm. The cotyledons of many plants, such as the sunflower, function as primary photosynthetic organs after germination and before the development of foliage leaves from the plumule.

Seed Viability. Some seeds, such as those of the willow, are viable, or capable of growing into healthy plants, for only a few days after falling from the parent tree. Other seeds are viable for years, seeds of the Oriental lotus being known to germinate 3000 years after dispersal.

SEED

Each species of plant has its specific period of viability; seeds sown after the period of optimum viability may produce weak plants or may not germinate. During the period of viability of each species, however, certain conditions may reduce the viability of an individual seed; seeds harvested before completing their maturation on the parent plant, or stored in moist, hot conditions, may suffer decreased viability.

Seed Testing. Most States of the United States require by law that dealers test their seeds for viability and purity before putting them on the market. A specific number of seeds are counted out, and the seeds are placed in an environment favorable to development; the percentage of viable seed in the batch of seed being tested is an index of viability of all seeds of the same lot. Seed testing also ensures the marketing of seed which is true to type, that is, which does not differ from the variety of plant desired to be grown.

Seed Dormancy. Lack of viability of seed is often confused with seed dormancy. Many seeds require a so-called resting period after falling from the parent plant before they are able to germinate into new plants. Among the members of the Orchid family, the seeds complete their maturation during this resting period. In other plants, chemical changes take place during the resting period which make the seed ready for germination. Still other seeds have extremely tough seed coats which must soften or decay before water and oxygen can enter the seed to take part in the growth of the embryo, or before the growing embryo is capable of bursting through the seed coat. Plant growers who wish to shorten the period of seed dormancy in seeds with undeveloped embryos can do little; germination may be induced, however, in seeds having mature embryos by abrasion of the hard coat, by soaking in water or in such chemicals as sulfuric acid, by heating to crack the seed coat, or by alternate freezing and thawing.

Seed Germination. The term germination is applied to the resumption of growth of the seed embryo after the period of dormancy. Germination does not take place unless the seed has been transported to a favorable environment by one of the agencies of seed dispersal. The primary conditions of a favorable environment are adequate water and oxygen, and suitable temperature. Different species of plants germinate best in different temperatures; as a rule, extremely cold or extremely warm temperatures do not favor the germination of seeds. Some seeds also require adequate exposure to light

before germinating. During germination, water diffuses through the seed coats into the embryo, which has been almost completely dry during the period of dormancy, causing a swelling of the seed; the swelling is often so great that the seed coat is ruptured. With the absorption of oxygen by the seed, energy is made available for growth; the foodstuffs stored in the endosperm or in the cotyledons are broken down by enzymes into simpler substances which are transported through the embryo to the various centers of growth. The radicle is the first portion of the embryo to break through the seed coat; it develops root hairs which absorb water and attach the embryo to particles of soil. The hypocotyl then lengthens, bringing the plumule and often the cotyledon or cotyledons above the surface of the soil. If the cotyledons are brought into light, they develop chlorophyll and carry on photosynthesis (q.v.) until the true foliage leaves develop from the plumule. In many plants, especially members of the Grass family, Gramineae, the cotyledons never appear above the surface of the soil, and photosynthesis does not occur until true leaves develop, the plant meanwhile subsisting on food stored in the seed. From the time of germination until the plant is completely independent of food stored in the seed, the plant is known as a seedling. Many seeds never germinate despite adequate viability and favorable conditions; such seeds have usually been attacked by fungi and bacteria. Seeds of cultivated plants may be treated with fungicides and bactericides to prevent this.

Seed Production. The raising of seed for agricultural and horticultural purposes is performed by plant breeders who specialize in producing seed true to type. Years of scientific research in plant breeding have resulted in the development of many plant varieties which are resistant to disease and temperature extremes, and which are larger or handsomer than their parent plants. See PLANT BREEDING.

Economic Importance of Seeds. Seeds, especially those of the cereal plants, form the greater part of the food of mankind. Cotton, which is used in the manufacture of textiles and many other products, is obtained from the hairy covering of the cotton seed. Various oils, such as linseed oil obtained from flaxseed, are expressed from seeds and are used in the arts, in industry, and as food. Seed hulls are often used as a mulching material (see MULCH) and as cattle fodder. See HORTICULTURE; PLANT MORPHOLOGY.

SEED PLANTS. See SPERMATOPHYTES.

SEEING EYE, INC., THE. See BLIND, AIDS FOR THE: *Rehabilitation*.

SEFERIÄDES, George, pen name **GEORGE SEFERIS** (1900–71), Greek poet, and diplomat, born in Smyrna, Greece (now İzmir, Turkey), and educated at the University of Paris. He entered the Greek diplomatic service in 1926, filling posts in Athens and serving as vice-consul in London, England (1931–34) and consul in Korçë, Albania (1936–38). In 1940–41, during World War II, he headed the foreign press division of the government. Upon the surrender of Greece to Germany in 1941, Seferiades joined the Greek government-in-exile. After World War II he held a government post in Athens and later various diplomatic posts in Great Britain and the Middle East. As ambassador to Great Britain from 1957 to 1962, he helped negotiate the treaty that gave Cyprus its independence; see **CYPRUS: History**.

While pursuing his diplomatic career, Seferiades was also active as a poet. Written in a precise, unembellished style, his works are noted for the beauty and clarity of style and the richness of symbolism. Among his various themes are the difficulties experienced by the Greeks in this century and the universal feeling of alienation. Volumes of his collected poetry include *The Turning Point* (1931), *Mythistorema* (1935), *Gymnopedia* (1936), *Log Book I* (1940), *Exercise Book, 1928–1937* (1940), *Log Book II* (1944), *Log Book III* (1955), *Poems* (1962), and two volumes translated into English, *The King of Asine and Other Poems* (1948) and *Poems* (1960). Seferiades was awarded the 1963 Nobel Prize in literature.

SEFERIS, George. See **SEFERIÄDES, GEORGE**.

SEGESTA or **SEGESTE**, originally **EGESTA**, ancient city of Sicily, about 25 miles w. of the modern city of Palermo. Although tradition attributes its foundation to refugees from Troy and connects it with the legendary hero Aeneas (q.v.), the city actually was founded by the Elymi, an indigenous people who gradually were absorbed by Greek colonists. In the 5th century B.C. Egesta was engaged in frequent strife with the neighboring city of Selinus (q.v.). The appeal of Egesta to the Athenians for aid was one of the ostensible reasons for the Athenian attack on Syracuse, which sided with Selinus, in 415 B.C. A later appeal to the Carthaginians (see **CARTHAGE**) resulted in the destruction of Selinus in 409 B.C. and a long war between the Carthaginians and the Greeks. In the First Punic War (see **PUNIC WARS**), the inhabitants of the city allied themselves with the Romans. See **SICILY: History**. The site was abandoned in the Middle Ages. The ruins include a large theater and an unfinished temple, one of

the best-preserved Doric temples in Sicily; see **GREEK ART AND ARCHITECTURE: Archaic Period: Middle Archaic Period**.

SEGO LILY. See **CALOCHORTUS**.

SEGOVIA, city in Spain, and capital of Segovia Province, on the Eresma R., about 40 miles N.W. of Madrid. The manufactures include liquor, leather goods, lumber, glassware, ceramics, and textiles. The oldest part of the city is surrounded by a wall with eighty-six towers, dating from the 11th and the 12th centuries. Within the wall is the famous Alcazar, an imposing castle built before the 14th century. Also in the old city is the cathedral, a large Gothic basilica, begun in 1525, with a square tower, more than 345 ft. high, crowned by a cupola. Water is still brought to the city by a Roman aqueduct, built in the time of the emperor Trajan (q.v.) and today the largest Roman monument extant in Spain. Pop. (1970 est.) 40,359.

SEGOVIA, Andrés (1894–), Spanish guitarist, born in Linares, and trained at the Granada Musical Institute. He made his concert debut in Granada at the age of fourteen and began his



Andrés Segovia

Dr. I. W. Schmidt and Hurok Attractions

international career in Paris in 1924. Generally considered the foremost classical guitarist of his time, he was responsible for bringing the instrument into the concert hall. Several important contemporary composers created works for Segovia, and he himself made many transcriptions for guitar (q.v.).

SEGRÈ, Emilio Gino (1905–), American physicist, born in Tivoli, Italy, and educated at the University of Rome. He taught physics at the universities of Rome (1928–36) and Palermo (1936–38). In 1938 Segrè immigrated to the United States to teach and perform research at

SEGREGATION

the University of California in Berkeley, and in 1944 he became an American citizen. During World War II he worked in Los Alamos, N.Mex., on the atomic-bomb project, returning to Berkeley in 1946. Segrè took part in the discovery of three chemical elements: technetium, astatine, and plutonium (qq.v.). In 1955 he and his colleague Owen Chamberlain (q.v.) first produced antiprotons, which carry negative charges, as opposed to the positive charges of ordinary protons. For this work, Segrè and Chamberlain shared the 1959 Nobel Prize in physics. *See also* ATOM AND ATOMIC THEORY.

SEGREGATION. *See* INTEGRATION.

SEGUIN, city in Texas, and county seat of Guadalupe Co., about 33 miles N.E. of San Antonio. A processing area, the city also manufactures fiber glass, steel goods, and furniture. In a cattle-raising region, the city produces oil and pecans. It is the site of Texas Lutheran College, founded in 1891. Founded in the 1830's, Seguin was incorporated in the 1850's. Pop. (1960) 14,299; (1970) 15,934.

SEICHE. *See* TIDES: *Tidal Currents and Waves.*

SEINE, river of France, rising on the plateau of Langres, N.W. of Dijon, and flowing N.W. past Troyes, Fontainebleau, Paris, and Rouen, into the English Channel. The estuary, about 6 mi. wide, passes between Le Havre and Honfleur. The river is about 482 mi. long. It is navigable for riverboats from Bar-sur-Seine, more than 350 mi. from its mouth, and for ocean shipping from Rouen, about 75 mi. from its mouth. The Seine drains an area of more than 30,000 sq.mi. It receives the Aube, Marne, and Oise rivers from the N. and the Yonne and Eure rivers from the S., and is connected by canals with the Scheldt, Meuse, Rhine, Saône, and Loire rivers. In January, 1910, disastrous floods occurred, the river rising more than 24 ft. above its normal level at Paris. In ancient times, the Seine R. was known as the Sequana.

SEISMOGRAPH, any instrument used for detecting, amplifying, and recording tremors and vibrations in the earth, such as the seismic waves caused by earthquakes and nuclear explosions; *see* EARTHQUAKE. The science itself is known as seismology (q.v.), and the seismic waves usually occur in the frequency range from 100 Hz. to 1/3000 Hz.

A seismograph basically consists of a large weight or pendulum (q.v.) suspended from a framework resting on a fixed base in the earth so that the weight is free to sway or vibrate. When the base is moved by earthquake shocks, the weight remains still because of inertia (q.v.). The motion of the base with relation to the mo-

tionless pendulum is amplified by mechanical or electrical means and is traced on a moving chart to give a graphical record of any movement in the earth's crust. Sensitive seismographs are mounted on massive bases usually fixed to bedrock so that they are virtually a part of the earth's crust. In most seismographic observing stations three seismographs are employed simultaneously, one to measure east-west vibration components, one to measure north-south components, and one to measure vertical, or up-and-down vibration. *See* GEOLOGY.

The seismograph is also extensively employed in petroleum prospecting. In the simpler prospecting procedures, dynamite or other explosives (qq.v.) are discharged at some distance from the portable seismograph station and the shock waves from the explosion are recorded. By analysis of the wave records an experienced seismologist or geophysicist (*see* GEOPHYSICS) may be able to locate potential petroleum-bearing rock structures deep underground; artificially induced waves in some petroleum-bearing strata differ markedly in the speed of transmission from those produced by adjacent rock formations. *See* PETROLEUM: *Oil Prospecting.*

The National Oceanic and Atmospheric Administration (q.v.) operates a tidal-wave warning service in the Pacific area based on the use of seismographs. Tidal waves may be caused by undersea earthquakes. When such an earthquake occurs, its position is located by seismograph stations and the time of arrival of the resulting waves is calculated. In this manner the approach of a wave may be anticipated by many hours, allowing time for warnings to be issued and danger areas to be evacuated. Seismographs are important in detecting secret nuclear-weapons tests; *see* DISARMAMENT: *Methods of Inspection*; NUCLEAR WEAPONS.

SEISMOLOGY, scientific study of earthquake phenomena and the study of the earth's interior by the use of seismic waves; *see* EARTHQUAKE. Seismology is concerned primarily with the analysis of seismic waves as recorded on the seismograph (q.v.). Such studies of the instrumental data enable the seismologist to locate earthquakes and learn something of the physical structure of the interior of the earth; *see* GEOLOGY; GEOPHYSICS.

Applications. Among the uses of seismological principles in industry are the seismic exploration methods employed to locate subterranean oil-bearing structures, in which explosions are used to generate artificial seismic waves. Engineering seismology is a special field dealing

with the study of destructive earthquake motions and the design of structures that will successfully resist them. A relatively new branch of the science, which may be called defense seismology, attempts to record and analyze the seismic waves caused by nuclear explosions; see DISARMAMENT: *Methods of Inspection*; NUCLEAR WEAPONS.

An earthquake generates two main groups of waves that are transmitted through the interior of the earth and another group that is transmitted along the surface only, all of them traveling at different speeds. From a vast accumulation of seismographic data seismological tables have been developed that show the time required by each group to travel any distance on the surface of the earth from an earthquake origin. When the arrival times of these wave groups, called phases, are analyzed, it is possible to determine the distance of the earthquake from the recording station. The epicenter, or point on the surface of the earth above the focus, is the common intersection of all arcs swung on a globe using the stations as centers and the respective distances as radii.

Geological Investigations. An analysis of travel-time curves shows the existence of two major discontinuities inside the earth, one at the bottom of the surface layer, 30 to 40 km (18.6 to 24.8 mi.) deep, and the other about 3000 km (1860 mi.) beneath the surface at the boundary of the so-called core. Because the core does not transmit wave types requiring rigidity, it has been termed a "liquid core" although it is not liquid in the usual sense of the word. Wave speeds in the earth can be correlated to a limited extent with those determined for certain types of rock in laboratory tests. As a result of these studies, the crustal layers have been designated as sedimentary, granitic, and basaltic, and the great solid portion between the crust and the core as the ultrabasic or transitional. The core has some of the characteristics of nickel and iron (qq.v.).

Noninstrumental investigations in seismology are usually limited to the study of intensity distribution in the central area of an earthquake where the motion is felt. The intensity and extent of sensible earthquake motion are shown on isoseismal maps on which lines are drawn around the epicenter through areas of similar intensities, as determined by canvassing or surveys. These lines correspond to certain degrees of intensity prescribed in established intensity scales, their pattern being controlled by the depth of the shock and the geology of the affected area.

C.C.



The seismograph recorder enables seismologists to locate earthquakes.

Environmental Science Services Admin.

SEKONDI-TAKORADI, city and port in Ghana, and capital of the Western Region, on the Gulf of Guinea, 110 miles s.w. of Accra. The city was formed in 1946 by joining the port of Takoradi and the city of Sekondi. The city is a fishing and trading center, and has railroad workshops, sawmills, cold-storage facilities, cocoa-processing, plywood, and tire-retreading plants. It is the site of Takoradi Polytechnic College and the Sekondi Regional Library. In the Sekondi section are the remains of Fort Orange (1642), which is now a lighthouse.

Sekondi was founded in the 16th century by the Dutch; English and Swedish forts were built in the 17th century. Under joint British and Dutch control until 1872, the city was ruled solely by Great Britain after that date. Sekondi began to flourish after 1903 when it was connected by rail to the mineral-rich interior. After a Swedish fort was built in Takoradi in 1640, the area remained undeveloped until the 1920's when port facilities were constructed. Pop. (1970) 91,874.

SELAGINELLA, genus of spikemosses constituting the family Selaginellaceae in the phylum Lycopsidea. The genus, which contains more than 500 living species, is chiefly native to the tropical and subtropical countries of the world; some species are cultivated in temperate regions for ornament. The plants usually have prostrate, creeping stems from which many branches arise; the small, scalelike leaves are arranged in four longitudinal rows along each

branch. The leaves bearing the sporangia are arranged in a cone; two kinds of spores are borne by plants of this genus: large spores that grow into female plants, and small spores that grow into male plants. The resurrection plant, *Selaginella lepidophylla*, is a well-known species, native to the tropics and subtropics of the Western Hemisphere; the plant curls into a dull-colored ball when dry, but unfolds and turns bright green when moistened.

SELDEN, John (1584–1654), English scholar and jurist, born near Worthing, West Sussex, and educated at Hart Hall, University of Oxford. In 1628 he helped draw up the Petition of Right, and in 1640 he served in the Long Parliament (q.v.). Although opposed to the crown, he withdrew from public life to protest the execution in 1649 of the English monarch Charles I (q.v.). He published numerous treatises in Latin and English and was an Oriental scholar. He is best known today for *Table Talk*, a collection of his sayings made by his secretary and published posthumously in 1689.

SELECTION. See NATURAL SELECTION; SEXUAL SELECTION.

SELECTIVE SERVICE or SELECTIVE CONSCRIPTION, terms used in the United States to designate the systems of military conscription established by Congress and in force during World War I and during and after World War II. For an account of U.S. conscription systems prior to World War I, see CONSCRIPTION.

World War I. The first Selective Service Act of World War I was passed in May, 1917, more than a month after the U.S. had declared war against Germany and her allies. The act provided for the registration of all men aged twenty-one through thirty; registrants were examined for physical and mental fitness and, if found to be ineligible for exemption on any of the specific grounds provided by law, were inducted into the armed forces. More than 9,925,000 men were registered in June, 1917, and of these about 687,000 were called up for service at once. A second conscription law was enacted in August, 1918, extending registration to all men between the ages of eighteen and forty-five. By the end of the war, more than 2,800,000 men had been inducted.

The system also provided manpower for industrial and agricultural war production. It exempted government officials and clergymen from service and excused conscientious objectors from combat duty. It allowed no bounties or substitutes.

The system was administered by 155 district and 4648 local boards under the provost marshal

general of the United States Army (q.v.). Men were chosen to serve by a lottery established in Washington, D.C., but the local boards could exempt or defer men on the ground of hardship.

Soon after the conclusion of hostilities the conscription system was abolished, and the vast majority of the conscripts was discharged from the armed services. No conscription system existed in the U.S. between the end of World War I and the year 1940.

World War II. In September, 1940, with a large part of the world already engaged in World War II, Congress passed the first conscription law ever enacted while the U.S. was at peace, the Selective Training and Service Act. This law provided for the annual induction of 900,000 men between the ages of twenty-one and thirty-six. Some 16,500,000 men were registered in accordance with the law in October, 1940, and the first group of conscripts, called selectees, was called up in the following month. Inductions continued during the ensuing year, and on Dec. 13, 1941, five days after the entry of the U.S. into World War II, the act of 1940 was altered to broaden its scope and allow for the rapid expansion of the armed forces. By the end of World War II, about 45,000,000 men had been registered, and more than 10,000,000 men, representing more than 66 percent of the total strength of the armed forces, had been inducted under the authority of this law.

Features of the system included registration, selection by lottery, reservation of industrial manpower, recognition of conscientious objection to war, and the right of those inducted to return to their old jobs. The system was administered by 6443 local boards and 505 appeal boards.

Peacetime Conscription. The act of 1940 expired in March, 1947. Shortly before that date, Congress established the Office of Selective Service Records, principally to preserve the records of the wartime conscription system for possible emergencies. The work of this agency greatly facilitated the implementation of the Selective Service Act passed by Congress in June, 1948, whereby peacetime conscription machinery was set up for the induction of men between the ages of nineteen and twenty-six for twenty-one months of service. Among those exempted from the provisions of this law were most veterans of World War II, the sole surviving sons of families that had lost all other sons during the war, and conscientious objectors found to be opposed to both combatant and noncombatant service. A maximum of 161,000 eighteen-year-old youths was permitted to en-



Secretary of War Newton D. Baker reaches into a bowl on July 20, 1917, to draw the first number in the draft of men to serve in World War I. UPI

list for a twelve-month period of service within the continental limits of the U.S.; upon the completion of this period they were assigned either to a reserve component for six years or to an organized reserve unit for four years.

Because of the high rate of voluntary enlistments, the army declared an unofficial "draft holiday" in March, 1949. Up to that time fewer than 30,000 men had been inducted out of the more than 9,000,000 who had registered under the 1948 law.

The Korean War. On June 22, 1950, the Selective Service Act, scheduled to expire on June 24, 1950, was extended by Congress to July 9, 1950. On June 27-28, soon after the outbreak of the Korean War (q.v.), Congress approved an additional one-year extension of the law to July 9, 1951. By the close of the year 1950, U.S. Army draft calls totaled about 210,000.

In June, 1951, Congress adopted the Universal Military Training and Service Act, which basically amended the act of 1948. The act provided for developing a plan for a universal military-training and service program. It lowered the draft-age liability to eighteen and a half and increased the period of military service to two years of active duty plus a maximum of six years in the reserves. Lowered physical and mental standards and a 5,000,000 limit for the armed-forces personnel were other important provisions.

SELECTIVE SERVICE

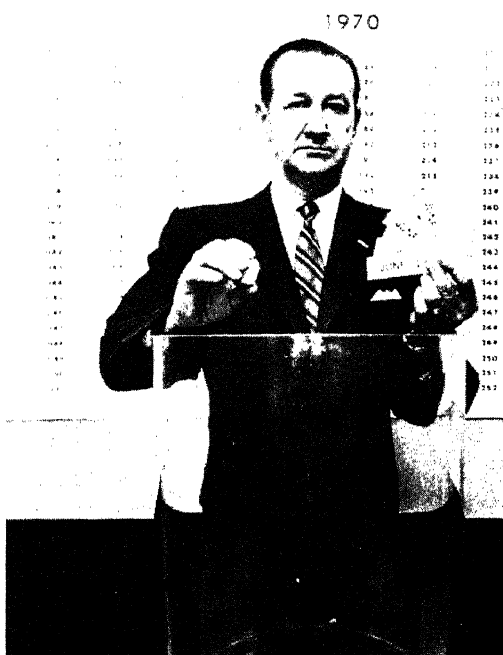
Selective Service qualification tests were given to college students seeking deferment, beginning in 1951. Selective Service boards, in determining whether to grant deferments, could be guided by grades obtained in these tests as well as by the scholastic standing of the student. These tests, discontinued in 1963, were resumed in 1966-67 but again abandoned because of the revision of the basic law.

Subsequent Legislation. An executive order from President John Fitzgerald Kennedy (q.v.) in 1963 authorized deferment for fathers and married men. A subsequent order in 1965 ended exemptions for men married after Aug. 26, 1965.

The system underwent major revision with the passage of the Military Selective Service Act of 1967. This act changed the name of the basic law and extended for four years the authority of the Selective Service System to order for induction men between the ages of eighteen and a half and thirty-five. Under the terms of the new act, deferment of undergraduate college students was continued for all who requested it and who satisfactorily pursued a full-time academic course; the deferment remained in effect until the student graduated or reached his twenty-fourth birthday, whichever came first.

Colonel Charles R. Fox (1912-) of the Selective Service System demonstrates the method used to draw dates for the lottery draft system, inaugurated in 1969. UPI

RANDOM SELECTION SEQUENCE



SELENE

Lottery Selection. On Nov. 26, 1969, President Richard Milhous Nixon (q.v.) signed into law an amendment to the Military Selective Service Act of 1967, which permitted establishment of a random selection sequence for induction into the armed forces. The first draft lottery since March 17, 1942, was held on Dec. 1, 1969.

The 1967 act was further amended in 1971. Men were required to register with a local board of the system within a sixty-day period commencing thirty days before their eighteenth birthday. Registrants were classified in one of various classes. Qualified registrants were placed in Class 1-A (available for military service), in Class 1-A-O (conscientious objector available for noncombatant military service), or in Class 1-O (conscientious objector available for alternate civilian service) and were selected for induction in an established order of call.

Among changes in the processing of registrants was the phasing out of student deferments. A new classification, 2-D, created a mandatory deferment for divinity students satisfactorily pursuing full-time courses. The lottery selection procedures were continued.

Other changes affected the makeup of local boards, which were required to be proportionately representative of the race and national origin of the registrants in their jurisdiction. The minimum age for board membership was reduced from thirty to eighteen; no person might serve who had reached age sixty-five or had served for more than twenty years.

On Jan. 28, 1973, Secretary of Defense Melvin R. Laird announced that the use of the military draft had ended, although the conscription law was not to expire until June 30. Men were still required to register, however, and the draft machinery was to be retained in case of emergency.

Organization. The Selective Service System is headed by a director, who is appointed by the President with the advice and consent of the Senate. The national headquarters coordinates activities of the State headquarters, which in turn supervise the local boards. The local board in each county or similar subdivision consists of three or more unpaid civilian members appointed by the President upon recommendation of the respective State governors. Each local board has authority to decide all questions of inclusion, deferment, and exemption from Selective Service for the area, but individual cases can be appealed to a State appeal board, and then to the President.

SELENE, in Greek mythology, goddess of the moon, the daughter of the Titans Hyperion

(qq.v.), and Theia, and the sister of Helios (q.v.), god of the sun. Selene fell in love with the handsome young shepherd Endymion (q.v.), whom she lulled into an eternal sleep so that he could never leave her. In art, Selene is represented driving a chariot drawn by two horses or, sometimes, by two oxen. Selene is often identified with the Olympian goddess of the moon Artemis (q.v.).

SELENITE (Gr. *selenē*, "moon"), variety of gypsum (q.v.) that occurs in transparent crystals or crystalline masses. It is so called because, according to a legend of Central Europe, the crystals form when the moon is on the increase. Extremely large crystals of selenite are found in southern Utah in geodes, or hollow rocks. Broad, transparent sheets of selenite can be split into extremely thin, transparent plates, used by the ancients in place of glass. Selenite today is quarried and used as ordinary gypsum. See CRYSTAL.

SELENIUM, nonmetallic element with at.no. 34, at.wt. 78.96; gray selenium: b.p. 685 C. (1265° F.) sp.gr. 4.79; and symbol Se. Selenium is related chemically to sulfur and tellurium. It was discovered in 1817 by the Swedish chemist Jöns Jakob Berzelius (q.v.) in a sulfuric acid residue and was so called because it was found in association with tellurium (Lat. *tellus*, "earth"). The element occurs in a few selenide minerals, the most common of which is clausthalite, or lead selenide. It also occurs with free sulfur and in many sulfide ores and is generally obtained as a by-product in the refining of copper-sulfide ores. The yield from by-product sources, however, is insufficient to supply the rapidly increasing industrial demand for the element. The world's first deposit of commercial-grade ore was discovered near Baggs, Wyo., in 1955.

Selenium, like sulfur, exists in several allotropic forms: a brick-red powder; brownish-black, glassy, amorphous mass called vitreous selenium; red, monoclinic crystals of specific gravity 4.5; and gray, lustrous crystals called metallic selenium. Chemically, selenium closely resembles sulfur. It forms selenious acid (H_2SeO_3) and selenic acid (H_2SeO_4), the respective salts of which are called selenites and selenates.

Metallic selenium conducts electricity and is a better conductor of electricity in light than in darkness, the conductivity varying directly with the intensity of light. It is therefore used in many photoelectric devices; see PHOTOELECTRIC CELL. In the form of red selenium or as sodium selenide the element is used to impart a scarlet-red color to clear glass, to glazes, and enamels. It is also used to a great extent as a decolorizer

of glass because it neutralizes the greenish tint produced by iron (ferrous) compounds. Small amounts of selenium are added to vulcanized rubber to increase resistance to abrasion. Sodium selenate is an insecticide used to combat insects which attack cultivated plants, particularly chrysanthemums and carnations; the insecticide is scattered around the roots, and is carried by the sap throughout the plant. Selenium sulfide is used in the treatment of dandruff, acne, eczema, seborrheic dermatitis, and other skin diseases.

SELEUCIA, name of several ancient cities located in Syria, Pisidia, Pamphylia, Cilicia, Caria, and Mesopotamia (qq.v.), and founded during the earlier existence of the dynasty of the Seleucidae (q.v.). Of these cities, two were especially important.

Seleucia Pieria, founded in 300 B.C. by the Babylonian king Seleucus Nicator at the foot of the Piéria Mts., about 4 miles N. of the mouth of the Orontes R. in Syria. It was the seaport of Antioch (q.v.) and rose to great prominence during the wars between the Seleucidae and the Ptolemies of Egypt for possession of Syria; see *PTOLEMY; SYRIA: History*. The Romans officially recognized the independence of Seleucia about 70 B.C. By the 5th century A.D., the city had fallen into decay. The many ruins on the site of Seleucia attest to its former prominence and splendor.

Seleucia on the Tigris, also built by Seleucus Nicator, sometime after 311 B.C., on the W. bank of the Tigris R., about 40 miles N.E. of Babylon (q.v.), which was despoiled to supply materials for its construction. Controlling the navigation of the Tigris and Euphrates rivers as well as the commerce of Mesopotamia, it rapidly rose to wealth and splendor, becoming a famous center of Hellenistic civilization. When in the 2nd century B.C. Babylonia came under the power of Parthia (qq.v.), Seleucia continued as a great commercial city and in the 1st century A.D. had a population of 600,000. The city was partly burned by the Roman emperor Trajan (q.v.) in 116 A.D., and in 164 A.D. was completely destroyed by the Roman general Avidius Cassius (d. 175 A.D.) in his campaign against the Parthians. The destruction of Seleucia marked the end of Hellenistic civilization in Babylonia. See *GREECE: History: Ancient Greece: Hellenistic Period*.

SELEUCIDAE, or **SELEUCIDS**, dynasty of kings reigning, from 312 to 64 B.C., over the portion of Asia conquered by Alexander III, King of Macedonia (q.v.), known as Alexander the Great, that included Syria, a large portion of Asia

Minor (q.v.), and the eastern provinces of Bactria, Sogdiana, Persia, and Babylonia. The Seleucids are especially important for their spreading of Greek culture throughout Asia Minor. Of the twenty-six members of the dynasty the following are the most important.

Seleucus I, surnamed **Nicator** (Gr., "the Conqueror") (358?–280 B.C.), King (306–280 B.C.). The founder of the dynasty, he was a Macedonian general serving under Alexander and, in the second partition of Alexander's empire in 321 B.C., was made satrap of Babylon, becoming king of Babylonia (qq.v.) in 312 B.C. In 301 B.C., he joined the confederacy against Macedonia and, upon the defeat and death of Antigonos I, King of Macedonia (see under **ANTIGONUS**), obtained the largest share of the spoils, including the whole of Syria and a great part of Asia Minor. He built numerous cities, including Antioch and several named for him as Seleucia (qq.v.). Toward the end of his reign, he proclaimed himself king of Macedonia, but was afterwards assassinated.

Antiochus I, surnamed **Soter** (Gr., "the Preserver") (324–261 B.C.), King (280–261 B.C.), son of Seleucus I. See under **ANTIOCHUS**.

Antiochus II, surnamed **Theos** (Gr., "the Divine") (286–247 B.C.), King (261–247 B.C.), son of Antiochus I. See under **ANTIOCHUS**.

Seleucus II, surnamed **Callinicus** (Gr., "the Gloriously Victorious") (265?–226 B.C.), King (247–226 B.C.), son of Antiochus II. During his reign, his dominions were invaded by Ptolemy III, King of Egypt (see under **PTOLEMY**), who finally was forced to withdraw. He also was attacked by his brother Antiochus Hierax (d. 226 B.C.), to whom he lost most of Asia Minor.

Seleucus III, surnamed **Soter** (Gr., "the Preserver") (245?–223 B.C.), King (226–223 B.C.), son of Seleucus II. He tried unsuccessfully to regain Asia Minor and was murdered by a group of conspirators.

Antiochus III, surnamed **The Great** (242–187 B.C.), King (223–187 B.C.), younger son of Seleucus II. See under **ANTIOCHUS**.

Seleucus IV, surnamed **Philopator** (Gr., "Lover of His Country") (217?–175 B.C.), King (187–175 B.C.), son of Antiochus III. The defeat of his father by the Romans made him virtually powerless. He was assassinated by one of his ministers, and since his son and heir was a hostage in Rome, the succession passed to his younger brother.

Antiochus IV, surnamed **Epiphanes** (Gr., "the Illustrious") (215?–163 B.C.), King (175–163 B.C.), younger son of Antiochus III.

He was succeeded by rulers who for the most

SELEUCUS

part were weak and incompetent. As the power of the Seleucids declined, the greater part of their dominions either were conquered or broken up into small kingdoms.

Antiochus XIII, surnamed ASIATICUS (d. 64? B.C.), King (69–64? B.C.), son of Antiochus X (d. 92 B.C.). He was the last of the dynasty. During his brief reign those lands that were still left to the kingdom came under Roman power and Syria became a Roman province.

SELEUCUS. See SELEUCIDAE.

SELF-DEFENSE, in law, defense of one's person or property from threatened violence or injury by the exercise of force. In most United States jurisdictions, a person may defend himself from assault or unlawful attack by the use of force, provided he uses no more force than is necessary to accomplish that result. He may not carry his forcible resistance to the point of taking life when he may safely retreat from his assailant. If he uses more force than is necessary to repel the attack, he will be liable both civilly and criminally for assault. Under these conditions both the assailant and the person assailed may be guilty of assault.

On the principle of self-defense a person may forcibly resist an illegal arrest. The resistance, however, must fall short of taking life. He may also forcibly resist an unlawful attack upon another person, particularly if the other person has a natural claim to his protection, as a wife, child, or a person in his company. The law of defense of property is the same as that relating to the defense of the person, except that under no circumstance is the taking of life as a means of protecting property justifiable. One who kills to protect property is guilty of manslaughter, and if the killing is premeditated it may be murder.

The law also recognizes a distinct right to protect the home. A person inside his own dwelling may forcibly resist attacks upon himself and the other occupants of the house and, without retreating, kill his assailant if necessary to repel the attack. See HOMICIDE; MANSLAUGHTER; MURDER.

SELFHEAL or **HEAL-ALL**, or **HEARTSEASE**, common name applied to a perennial prostrate herb, *Prunella vulgaris*, belonging to the Mint family, Labiatae. The selfheal, which is native to Eurasia, has been widely naturalized throughout the temperate regions of the world as a weed. The plant is so called because of an ancient belief that it possesses medicinal qualities. It grows to a height of about 1 ft. The small purplish or bluish flowers are borne in closely packed spikes. Selfheal commonly grows on lawns and cultivated land, and appears along

roadsides and on the borders of wooded regions throughout the United States.

SELIHOT. See PRAYER, JEWISH.

SELINUS, ancient ruined Greek city on the S.W. coast of Sicily, at the mouth of the Selinus R. (now the Madione R.), near the modern village of Marinella. The city was founded about 628 B.C. by Dorian Greek colonists from the ancient Sicilian city of Megara Hyblaea, near Syracuse (q.v.); see DORIANS. From the early 6th century B.C. the inhabitants of Selinus waged constant wars with the people of the neighboring Greek city of Segesta (q.v.). In the 5th century, Selinus formed a military alliance with Syracuse, and an appeal from the people of Segeste for aid was the main reason for a disastrous expedition sent from Athens (q.v.) to Sicily in 415 B.C. In 409 B.C., during the Carthaginian invasion of Sicily, Selinus was captured and destroyed; see CARTHAGE. Although rebuilt, the city never regained its former prosperity, and about 250 B.C., during the First Punic War (see PUNIC WARS), it was again destroyed by the Carthaginians and its inhabitants were transferred to the nearby city of Lilybaeum (modern Marsala). The ruins of Selinus include the walls of the ancient acropolis, the remains of several fine temples which are in two groups, five on the acropolis and three on a hill to the E. of the city. The temples offer some superb examples of Doric architecture (see GREEK ART AND ARCHITECTURE: *Archaic Period*); one of the group outside the city, apparently dedicated to the god Apollo (q.v.), is among the largest Greek temples known to have existed.

SELJUKS, ruling Turkish tribe, part of the Ghuzz confederacy, which invaded western Asia in the 11th century and founded a dynastic empire. They were settled in Transoxiana, north of the present-day Amu-Dar'ya R. in Uzbek S.S.R., Soviet Union, when they became converted to Islam (q.v.). Togrul Beg (d. 1063), grandson of a chief named Seljuk (fl. 10th cent.), conquered all Persia. During the reign of his son Malik Shah (r. 1072–92), his grand vizier, Nizam-al-Mulk (1018–92), founded a university at Baghdad, and with Omar Khayyám (q.v.) revised the astronomical tables and introduced a new era, the Jellalian. After the death of Malik the empire began to break up into smaller kingdoms, and came to an end in 1157 after attacks by the shah of Khorezm. The Turkish Empire, founded by the Seljuks, was continued by the Ottoman Turks; see TURKEY: *History: Rise of the Ottoman Empire*.

SELKIRK, Great Britain, county of S.E. Scotland, bounded by the counties of Peebles, Midlothian, Roxburgh, and Dumfries. It is drained by

the Tweed, Ettrick Water, and Yarrow Water rivers. The chief heights, which are on the borders of Peebles County, are Broad Law (2754 ft.) and Lochcraig Head (2625 ft.). Much of the region consists of grassy rounded hills, and sheep farming is an important industry; woolen products are the chief manufacture in the county town, Selkirk, and in the largest town, Galashiels. The parish of Ettrick, in the s.w. part of Selkirk Co., is the birthplace of the British poet James Hogg (q.v.). Area, 267 sq.mi.; pop. (1971) 20,678.

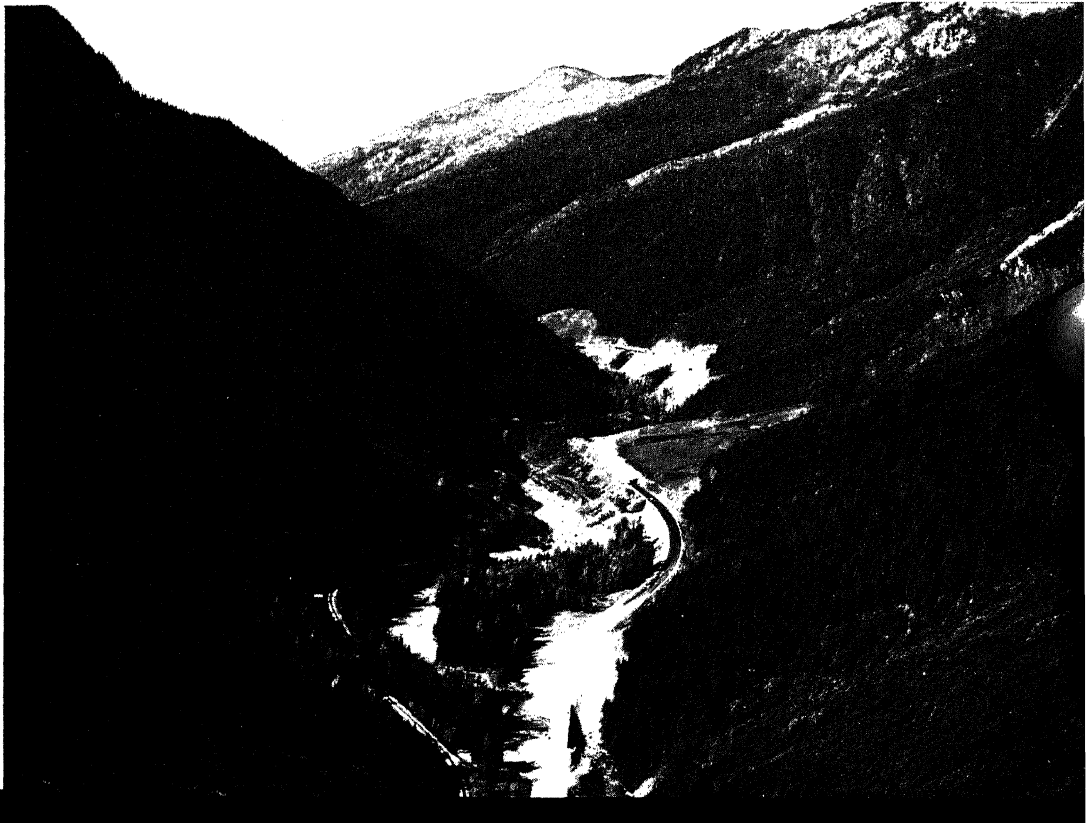
SELKIRK, Alexander or SELCRAIG, Alexander (1676–1721), Scottish sailor, born in Largo, Fife Co. He first went to sea in 1695. In 1703 he became sailing master on the ship *Cinque Ports*, one of the two vessels of a privateering expedition under the English navigator William Dampier (q.v.). While the expedition was near the Juan Fernández Islands, off the coast of Chile, Selkirk had a dispute with the captain of his ship. At his own request he was put ashore in October, 1704, on one of the islands. He lived alone there until rescued in February, 1709, by the commander of an English privateer, the *Duke*. Selkirk subsequently continued his career as a sailor, and at the time of his death he was master's mate on the British man-of-war *Weymouth*. The story of his solitary sojourn on Más a Tierra Island (now Isla Robinson Crusoe), was

related in a number of versions by early 18th-century writers such as the British essayist Sir Richard Steele (q.v.). It also suggested to the British novelist Daniel Defoe (q.v.) the plot of his novel *Robinson Crusoe* (1719).

SELKIRK MOUNTAINS, range of the Columbia Mts., extending s.e. for about 320 km (200 mi.) from s.e. British Columbia, Canada, into N. Idaho. The Selkirks are bordered on the e. by the Purcell Mts. and on the n. and w. by the Columbia R. The loftiest peaks of the range, including the highest point, Mt. Sir Sandford (3521.8 m/11,555 ft. high), are situated in the n. The Trans-Canada Highway and the Canadian Pacific Railway cross the N. Selkirks at Rogers Pass (1382 m/4534 ft. high); the railway uses the Connaught Tunnel under the pass.

SELMA, city in Alabama, and county seat of Dallas Co., on the Alabama R., 50 miles w. of Montgomery. The city is the marketing center of a rich lumbering and agricultural region, noted for the production of livestock, cotton, grain, pecans, and dairy products. The chief manufactures in the city are lumber products, agricultural machinery, cigars, and refined magnesium. Nearby is Craig Field, a United States Air Force base. Selma was founded in 1815, incorporated

Aerial view of Rogers Pass in the Selkirk Mts. of British Columbia.
National Film Board of Canada



as a town in 1820, and chartered as a city in 1852.

In 1965 the city became a center of the civil rights movement when violence erupted during a Negro voter registration drive; see CIVIL RIGHTS AND CIVIL LIBERTIES. A protest march from Selma to Montgomery, in which 25,000 people were involved, was led by the American civil rights leader Martin Luther King, Jr. (q.v.).

Population (1960) 28,385; (1970) 27,379.

SELYE, Hans (1907–), Austrian-Canadian physician, born in Vienna, and educated at the universities of Paris, Rome, and the German University at Prague, Czechoslovakia. In 1931 he was awarded a research fellowship in the department of biochemical hygiene at Johns Hopkins University. The next year, he became a fellow at the department of biochemistry at McGill University, Montréal, where he stayed to become lecturer and assistant professor in biochemistry (1933–37), and assistant and associate professor of histology (1937–45). He then became director of the Institute of Experimental Medicine and Surgery at the university.

Selye specialized in research into the physical and chemical effects on the human body of the stresses of modern living. He emphasized this concept of stress, which in his opinion gives rise to mental and physical tensions that could be causal factors in various diseases. He termed the human or animal responses to the stresses that disturb their relative states of equilibrium (q.v.) "the general adaptation syndrome", and he found that the responses varied according to the animal. Among his many works are *The Stress of Life* (1956), *The Chemical Prevention of Cardiac Necroses* (1958), *Calciphylaxis* (1962), *The Mast Cells* (1965), *Thrombohemorrhagic Phenomena* (1966), and *Experimental Cardiovascular Diseases* (2 vol., 1970).

SEMANTICS, theory concerned with meaning as expressed in signs, that is, symbols, words, and other means of communication. The theory may be considered to consist of three distinct divisions, namely semasiology, or linguistic semantics, which is a branch of linguistics; semiotics, the general theory of signs; and general semantics. Semasiology is the investigation of meaning in languages, with particular reference to individual words. Semiotics, as systematically developed by the American philosopher Rudolf Carnap (1891–1970), is the body of theory which, in general, formulates semantical rules for language used in science. General semantics, as originated by the Polish-American engineer and writer Alfred Habdank Skarbek Korzybski (1879–1950) and his associates, is the

study of meaning as it affects human behavior and the evaluation of language. Each of the three divisions of semantics is concerned in some respects with the relation of the sign to what it signifies.

SEMASIOLOGY, OR LINGUISTIC SEMANTICS

Semasiology is concerned with the meanings of words in terms of context. It is divided into descriptive semantics, that is, the study of the meaning of words in a language at one particular period, and historical semantics, the tracing of shifts in the meanings of words over a period of time.

Descriptive Semantics. Descriptive semantics demonstrates that context indicates the meaning of words in several specific ways, including emotive value, semantic range, and shifts in application. It studies also such word phenomena as polysemy, or multiple meaning, and homonymy, or the sharing by different words of the same sound or spelling. The emotive value of a word is changed by the associations given to it in different contexts. To a flagmaker a flag is a piece of cloth having a certain design and certain colors; to a patriot, the flag of his nation or of an enemy nation is capable of inspiring strong feelings which have nothing to do with the particular piece of cloth but are based on a series of associations resulting from his experiences. An example of semantic range may be observed in some of the uses of the word "man". In a context with "woman", the word distinguishes the sexes; its meaning is relatively narrow. Opposed to "animal" or "God", the word includes both "man" and "woman" as defined in the narrower usage.

Shifts of application change the meanings of a particular word. For example, the verb "to work" has a different shade of meaning in each of the following sentences: "I work in a store"; "The elevator doesn't work"; "He worked himself into a frenzy"; "The anchor worked loose"; "He worked the crossword puzzle"; and "He worked his way around the world." In all of these sentences, however, the word "work" has the common meaning "some exertion made toward some effect or result".

Polysemy is the linguistic condition in which the same word has several distinct meanings, for example, the different meanings of the word "foot" in the expressions "the human foot", "the foot of a mountain", and "a foot in length".

Homonyms are divided into homophones, that is, words having the same sound, and homographs, words having the same spelling. Examples of homophones are "hear" and "here", and

"hair" and "hare". The noun "see", which means "a district under the control of a bishop", and the verb "to see" are homographs. Although they have different meanings and etymologies, both are spelled the same way.

Historical Semantics. Important processes studied in historical semantics include narrowing, widening, transfer, amelioration, and pejoration. The history of the English word "poison" exemplifies narrowing of meaning. The Latin word *potionem*, from which "poison" derives, meant any of several medicinal drinks, but poison expresses the same idea as venom. The English word "potion" retains some of the meaning of the same Latin word, from which it also derives. The word "barn" is an example of widening of meaning. It comes from the two Old English words for "close place" and "barley" which, when used together, denoted "a close place in which to keep barley". After the word widened in meaning it came to denote in modern English "a general storage place for grain, tools, and animals". Examples of the transfer of meaning are the use of the word "tongue" in the sense of "language" and of the word "eye" in the phrase "eye of a needle".

Amelioration and pejoration, that is, the acquisition of better and of worse meanings, are opposite aspects of one general principle. In the course of time a respectable or polite word may take on a bad or unpleasant connotation. For example, at one time the word "hussy" meant "housewife", of which it is a contraction; the present meaning "worthless woman" originally was in no way implied by the word. Examples of words which became elevated in tone or meaning are "bishop" and "angel". "Bishop" is taken from an ancient Greek word which means overseer. "Angel" is derived from a Greek word used to designate any ordinary messenger.

SEMIOTICS

In modern logic semiotics is defined as the study of the laws and conditions under which signs and symbols, including words, may be said to be meaningful. Semiotics embraces three branches, namely pragmatics, the theory of the relations between signs and those who use them; syntactics, the theory of formal relations among signs; and semiotic semantics, the theory of the relations between signs and what signs refer to.

Semiotics is concerned chiefly with developing knowledge about language in order to increase its usefulness in scientific work. Semiotic theory maintains that a language about language is necessary in order to use language scientifically.

In semiotics, the language which is described or spoken about is called the object language; the language used to describe or speak about the object language is called the metalanguage. For example, if one discusses in English the grammatical structure or the literature of modern German, the latter is the object language and English is the metalanguage. Object language and metalanguage may also be the same, as when one describes English in English.

According to semiotic theory, the three requirements for using a language scientifically are an uninterpreted formal system, that is, an object language; a set of semantical rules; and an interpreted but unformalized metalanguage, in which the semantical rules are formulated.

Logical Semantics. The branch of semiotics known as logical semantics is divided into two subbranches: descriptive semantics and pure semantics. Descriptive semantics is the semantical study of actual languages such as French and English and is akin to semasiology. Pure semantics is the analysis of semantical systems or systems of semantical rules; it is entirely analytic and without factual content. The following is an example of the use of a semantical rule. In order to understand the statement "A thing is, or it is not" the rule of "not" is necessary. According to the rule, the sentences "Chicago is in Illinois" and "Chicago is not in Illinois" are logically exclusive or incompatible. Statements made under the rules formulated by semiotics restrict language to the expression of declarative sentences only, such as "Mr. Smith makes shoes" or "The boiling point of water is 100° Centigrade."

In a semantical system a set of rules referring to the object language is set up in the metalanguage. The purpose of the rules is to determine a truth-condition, that is, a general statement of the condition which must be fulfilled if a sentence is to be taken as true, for any given sentence in the object language. This step is in preparation for discovering the truth-value of a sentence, or the degree to which a sentence states what is really the case. The semantical rules are used to interpret the meaning or sense of the sentence being tested. For example, if one knows English, one understands the sentence "The Golden Gate Bridge is red" although one may not know its truth-value. The truth-condition for this sentence is that the sentence is true if an object, the Golden Gate Bridge, is a certain color, red. To determine the truth-value one must look and see if the bridge is red.

GENERAL SEMANTICS

General semantics is an educational discipline developed to train persons to evaluate the

SEMANTICS

words and symbols used in their environment. General semantics contrasts the exact use of symbols common in science and technology with the inaccuracy and confusion in the way meaning is evaluated in nonscientific areas such as politics and daily living. According to the theories of general semantics popular thinking follows prescientific patterns of evaluation not in keeping with scientific discoveries.

An analogy used in general semantics to explain its basic principles is that of the relationship of a map to the territory that it purports to describe. An accurate map must conform to recent discoveries about the territory. A map of the world made before the time of the Italian-born navigator Christopher Columbus would not reflect accurately the world as it is known today. Words and concepts are like maps. To be accurate in evaluation an individual must be aware of the fact that the words and concepts he uses are not the reality supposedly described by those words and concepts. Three basic premises underlie the general-semantics approach to meaning. (1) Just as a map is not the territory, words are not the things they represent. (2) Just as a map does not represent all of a territory, words cannot say all about anything. (3) Just as a map is self-reflexive, in the sense that an ideal map would have to include a map of the map, it is possible to speak words about words, for example, the terms "object language" and "metalanguage" which are used in semiotics.

Certain rules designed to aid individuals in evaluating their own evaluative processes are formulated in general semantics, among them the rules pertaining to indexing, dating, the use of *et cetera*, the "is" of identity, quotation marks, and hyphens.

Indexing. As a reminder that things or events having the same word or name applied to them are not indeed the same, individual elements are indexed. Thus Republican₁ is not Republican₂; union₁ is not union₂. By using indexes, the user of language becomes wary of making loose generalizations about individuals lumped under such general terms as "Republican" and "union".

Dating. The world and everything in it is in a process of change, but many behavior patterns, opinions, and beliefs tend to remain static. Dating is a reminder, for example, that United States foreign policy₁₉₅₇ is not United States foreign policy₁₉₅₈. John Smith_{Monday} is not John Smith_{Tuesday}. When translated into patterns of reaction, the habit of dating all terms and statements makes rigidity of attitudes impossible and a dynamic time-minded orientation habitual.

Et Cetera. The term "*et cetera*" is appended at least by implication to any statement about objects or events in the real world, because such statements can never be final.

The "Is" of Identity. The word "is" in English, as, for example, in the sentence "He is a sailor", implies that "he" has all the characteristics applied to the word "sailor". Careless reaction to "is" permits the false assumption that the common meaning given to the symbol is true without qualification for a particular case.

Quotation Marks. Many terms in everyday language have prescientific metaphysical or structural implications. A rule of general semantics is that such words as "mind" or "race" should be put in quotation marks as a reminder that they are not to be trusted.

Hyphens. Words tend to separate what in reality are not separate entities. Hyphens are used often in general semantics to connect words designating aspects of reality which are connected rather than separate. For example, the American theoretical physicist Albert Einstein showed that space and time should be thought of in terms of "space-time" and not as individual entities.

The principles of general semantics are applied in many fields, including education, psychotherapy, business administration, advertising, and the law. Some philosophers and philologists, however, criticize general semantics on the grounds that it does not satisfy the tests of rigorous scientific method.

HISTORY

Semasiology is older than either semiotics or general semantics, and on the whole it developed independently of those bodies of theory. In 1883 the French philologist Michel Jules Alfred Bréal (1832–1915) proposed a science of significations to discover the laws which determine the transformation of the senses of expressions, including their origin and obsolescence. The French philologist Arsène Darmesteter wrote a pioneer work in this field entitled *La Vie des Mots Étudiée dans Leurs Significations* ("The Life of Words Studied According to their Significance" 1887).

In 1897 appeared Bréal's major contribution to semasiology, entitled *Essai de Sémantique: Science des Significations* (Eng. trans., *Studies in the Science of Meaning*, 1900). In his *Cours de Linguistique Générale* (1916; Eng. trans., *Course in General Semantics*, 1966), the Swiss philologist Ferdinand de Saussure (1857–1913) makes the distinction between the language system (*la langue*) and that language as used by individuals (*la parole*). The voluminous literature on se-

masiology appearing in learned journals demonstrates that modern semasiologists continue to search for scientifically established laws of change of meaning in terms of the relation between the sign and the thing signified. A thorough and scholarly review of semasiology is contained in *The Principles of Semantics* (2nd ed., 1959) by the British philologist Stephen Ullmann (1914–).

Later 20th Century Developments. The movements important in semantics are closely related in time and basic concerns. In the early part of the 20th century a new emphasis in studies of the nature of meaning was inaugurated by the British author Viola Welby in *What Is Meaning? Studies in the Development of Significance* (1903). Viola Welby was dissatisfied with what she called the senseless formalism of the teaching methods then current. Consequently she formulated a theory of what she termed “significs”, that is, a general theory of meaning, as a method of training to create a new attitude toward experience, upon which all language is based. The British philosophers Alfred North Whitehead and Bertrand Arthur William Russell in their monumental work on logic and mathematics, *Principia Mathematica* (1910), pointed out that ambiguities of language conceal certain “illegitimate totalities”, which, undetected, lead to “vicious circle fallacies”. Whitehead’s and Russell’s analyses in turn influenced the logical positivist school of philosophy, known also as the Vienna circle. The Austrian philosopher Ludwig Wittgenstein, a leader of this school, showed through logical analysis in his major work *Tractatus Logico-Philosophicus* (1921) that practically all the traditional problems of philosophy arose from the lack of understanding of what he referred to as the “logic of our language”. In their book *The Meaning of Meaning* (1923), the British psychologist and educator Charles Kay Ogden (1889–1957) and the British literary critic, semanticist, and educator Ivor Armstrong Richards continued the work of Viola Welby by introducing into the study of meaning fresh perspectives drawn from psychology, anthropology, and the physical sciences.

Basic Texts. Recent developments in semiotics in large part resulting from investigations cited in the foregoing may be found in the works of the American philosophers Charles William Morris (1901–), especially *Signs, Language and Behavior* (1948), Rudolf Carnap (1891–), especially *Introduction to Semantics* (1942), *Formalization of Logic* (1943), and *Meaning and Necessity* (1947 and 1956).

The fundamental texts for general semantics

are the works of the American scientist Alfred Korzybski, especially *The Manhood of Humanity* (1921) and *Science and Sanity; an Introduction to non-Aristotelian Systems* (1933). Applications and further development of Korzybski’s basic investigations are found in a number of sources. Among these are *The Power of Words* (1954), by the American writer Stuart Chase (1888–); *Language in Action* (1941; expanded in 1949 under the title *Language in Thought and Action*), by the American educator and writer Samuel Ichiye Hayakawa (1906–); *People in Quandaries: The Semantics of Personal Adjustment* (1946), by the American writer Wendell Johnson (1906–65) and two works by the American mathematical biologist and semanticist Anatol Rapoport (1911–), namely, *Science and the Goals of Man: A Study in Semantic Orientation* (1950) and *Operational Philosophy* (1953). The most recent statements by writers on general semantics may be found in *Language, Thought, and Reality* (1956), selected writings of Benjamin Lee Whorf (1897–1941), edited by J. B. Carroll, and in *Our Language and Our World* (1959), edited by Hayakawa. Current viewpoints on general semantics are expressed in the quarterly journal *ETC.*, published by the International Society for General Semantics.

See separate biographies on most of the persons for whom life data is not given. R.E.B.

SEMARANG, city and port in the Republic of Indonesia, and capital of Central Java Province, on the N. coast of the island of Java, on the Java Sea, at the mouth of the Semarang R., about 250 miles S.E. of Djakarta. It is a major seaport and commercial center for central Java, with an excellent harbor that is, however, accessible only in the dry season. The city has shipyards, railroad workshops, and industries in which machinery, electrical equipment, shoes, textiles, and glass are manufactured. The chief exports are sugar, copra, tobacco, coffee, and rubber. Pop. (1971) 646,590.

SEMELE, in Greek mythology, the daughter of Cadmus and Harmonia, King and Queen of Thebes, and the mother of the god Dionysus (qq.v.). Hera, the jealous wife of Zeus (qq.v.), realizing that her husband was madly in love with the Theban princess, tricked Semele into asking to see Zeus in his full splendor. Bound by an oath, Zeus appeared before the unfortunate woman in all his glory. As Semele gazed upon the wondrous sight she was consumed by the lightning bolts of the god. Zeus was able to rescue her child, Dionysus, from the ashes, however, and he hid the fetus in his side until it was time for it to be born. Later the young god res-

cued Semele from the underworld and brought her to Olympus (q.v.) to live among the gods.

SEMENOV, Nikolai Nikolaevich (1896–), Soviet physical chemist, born in Saratov, and educated at the University of Petrograd, now Leningrad State University. He became assistant professor of chemistry at the Leningrad Polytechnic Institute in 1920 and later became professor. He became director of the Institute of Chemical Physics in Moscow in 1931, and was elected to the U.S.S.R. Academy of Sciences in 1932. He was appointed professor at the Moscow State University in 1944. Semenov made notable theoretical contributions in the field of kinetics of chemical chain reactions, for which he shared the 1956 Nobel Prize in chemistry with the British chemist Sir Cyril Norman Hinshelwood (q.v.). The results of his research were applied in many industrial fields and are of great significance in the development of rocket fuels. He was awarded five orders of Lenin and in 1958 was elected member of the Royal Society of England. He became an honorary life member of the New York Academy of Sciences in 1962, and is the author of several books including *Chain Reactions* (1934), and *Some Problems of Chemical Kinetics and Reactivity* (1954; Eng. trans. 1959).

SEMICONDUCTOR. See SILICON; TRANSISTOR.

SEMINOLE, city of Oklahoma, in Seminole Co., about 48 miles S.E. of Oklahoma City. The trade center for the surrounding oil region, the area produces cotton, poultry, and dairy products. Manufactures include machine-shop products and oil-field supplies. It is the site of Seminole Junior College, founded in 1931. Settled in 1890, Seminole was incorporated as a town in 1908. With the discovery of oil in 1926, Seminole was chartered as a city. Pop. (1960) 11,464; (1970) 7878.

SEMINOLE WARS, two wars between the Seminole Indians and the United States, the first from 1817 to 1819 and the second from 1835 to 1842. The Seminole Indians were related to the Creek (q.v.) Indians but had withdrawn from the main body of that tribe in the mid-18th century. They occupied lands in northern Florida that were coveted by American settlers in the neighboring State of Georgia, although Florida at the beginning of the 19th century belonged to Spain; see FLORIDA: *History*. Another cause for dissension was the Seminole practice of giving refuge to fugitive slaves from Georgia and South Carolina.

While the U.S. was fighting the War of 1812 (q.v.) with Great Britain, a series of incidents led to an increase in hostility between the U.S. and



Osceola (1804–1838), war chief of the Seminole Indians.
Smithsonian Institution

the Seminole. In 1817 the first Seminole War was begun when the American general (later President) Andrew Jackson (q.v.) was sent with an army to Florida to quell the Seminole and seize that territory from Spain. After destroying several Indian settlements, General Jackson captured the city of Pensacola (q.v.) in May, 1818, and deposed the Spanish government. Florida became U.S. territory in 1819 and colonists entered from the north, causing the Indians to move south into regions unsuitable for their agricultural economy. In 1823 the Seminole officially ceded most of their former tribal lands to the U.S. and in 1832, by the treaty of Paynes Landing, the tribe was bound to move to territory west of the Mississippi R. within three years. Widespread opposition to this treaty, headed by the Seminole leader Osceola (q.v.), led to the outbreak of the second Seminole War. In 1837 Osceola was captured while under a flag of truce, but the war, which for the U.S. was extremely costly in both troops and revenue, continued until the Seminole finally surrendered in 1842. The majority of the tribe was then moved to the present-day State of Oklahoma, where their descendants were estimated in 1969 to number about 7000. A small group, however, remained in the Everglades (q.v.) of southern Florida. Their descendants, who did not sign a peace treaty with the U.S. until 1935, were estimated in 1969 to number about 960.

See AMERICAN INDIANS: *Indians of the United States and Canada: Southeastern Area.*

SEMPALATINSK, city and port of the Soviet Union, in the Kazakh S.S.R., and capital of Semipalatinsk Oblast, on the Irtysh R., about 330 miles s. of Novosibirsk. The city is in a rich agricultural district, and it is a major river port and a trading center for wool, livestock, and tallow. Nickel and chromium are mined in the vicinity. The principal industries in the city include meat-packing and the manufacturing of leather, silk, sheepskin products, alcoholic beverages and flour. Semipalatinsk was founded in 1718. Pop. (1970) 236,000.

SEMITES, term first used toward the end of the 18th century for peoples listed in the Bible (Gen. 10:21–32) as descended from Shem, the eldest son of the Biblical patriarch Noah (q.v.). Today, however, the term “Semite” is a linguistic, not a racial, classification; it refers to peoples who spoke or speak any of the Semitic languages (q.v.). Ancient peoples grouped under this term include those inhabiting Aram, Assyria, Babylonia, Canaan (including the Hebrews), and Phoenicia (q.v.). The best-known modern peoples speaking Semitic languages are the Arabs and Jews (q.v.); see ARABIC LANGUAGE AND LITERATURE; HEBREW LANGUAGE .

The original homeland of the Semites is not definitely known. Scholars think it probably was in southwestern Asia, and some even locate it specifically in Arabia (q.v.). Evidence uncovered by archeologists indicates that Semitic-speaking peoples were scattered over Mesopotamia (q.v.) before the establishment of urban culture there; and it is thought that waves of Semitic nomads, beginning presumably in prehistoric times, successively swept over the deserts westward into the Fertile Crescent. Today, the Semitic-speaking peoples (chiefly Arabs) are concentrated in the Middle East and northern Africa. Their influence, however, in recent historic times has been extended by the Jews as far as Europe and America, and by the Arabs into Africa south of the Sahara and eastward to the subcontinent of India.

Semitic peoples have been credited with inventing the alphabet (q.v.). The three major monotheistic religions, Christianity, Islam, and Judaism (q.v.), were born in their midst.

SEMITIC LANGUAGES, family of highly inflected languages, now spoken principally in the Middle East and north Africa; see INFLECTION. These languages have marked affinities with the so-called Hamitic languages (q.v.) spoken in parts of north Africa, and together they form coordinate branches of the Afro-Asi-

atic linguistic family (see AFRICAN LANGUAGES).

Compared to the territory throughout which the Indo-European languages are spoken, the area of Semitic speech is exceedingly limited. Except for modern Arabic and modern Hebrew, which have been carried by Arabs and Jews to far-flung parts of the world, the region within which the Semitic languages prevail is bounded on the west by the Mediterranean Sea, on the east by the Euphrates R., on the north by the Taurus Mts., and on the south by the Indian Ocean. Because of the narrowness of these confines the various Semitic tongues are much more closely related to one another than are the Indo-European languages.

Characteristics and Divisions. Salient characteristics of the Semitic languages are: (1) root words formed of three consonants; (2) the use of prefixes, suffixes, infixes, and inflectional endings to denote precise variations in the meaning or relations of words; (3) substantial agreement in the formation of noun and verb; and (4) the use of consonants alone, notably h, n, sh, and t, in the formation of prefixes and suffixes.

No less than three distinct types of Semitic writing are found, namely: the cuneiform (q.v.) characters of Babylonia and Assyria, which, originating from pictographs (see HIEROGLYPHICS), gradually became wedge-shaped; the North Semitic alphabet, from which the various later Aramaic (see ARAM) and North Arabic alphabets were derived; and the South Semitic alphabet, used by Himyarites, Minaeans, and Sabaeans, from which the Ethiopic alphabet was derived. The earliest genuine alphabet was probably developed in the Semitic languages.

Philologists divide the Semitic languages into various branches and subgroups. The only living Semitic languages are modern Hebrew (mainly used in Israel), a few remnants of other subgroups, and the youngest subgroup, Arabic. The accepted distribution of the Semitic languages, omitting minor dialects, is as follows:

1. EAST SEMITIC. Generally known as Akkadian, the language of the Babylonian and Assyrian cuneiform inscriptions; used principally in ancient Babylonia, Assyria, and Chaldea.
2. WEST SEMITIC
 - A. North or Northwest Semitic. The ancient languages of Mesopotamia and Syria-Palestine, usually divided into an earlier and a later group:
 1. The Canaanite dialects, of which Hebrew, Phoenician, and Ugaritic are the most important. See CANAAN.
 2. Aramaic, the most widely spread language of western Asia for many centuries before and after

Continued on page 248

Continued from page 247

the Christian era. The Aramaic group includes a large number of dialects, the most important being Syriac (sometimes called eastern Aramaic), a Christian literary dialect of northwestern Mesopotamia. Other eastern dialects are Mandæan and the language of the Babylonian Talmud. Western Aramaic includes Nabataean, Palmyrene, Judean Aramaic (in the post-Biblical writings of the Palestine Jews), and the Christian Aramaic dialect of Palestine. Neo-Aramaic survives today in a few communities of Syria, Mesopotamia, and Armenia.

B. South or Southwest Semitic. The ancient languages of Arabia and their modern subgroups. These are divided into:

1. Northern Arabic, the literary Arabic of the medieval Muslim world, modern literary Arabic, and the dialects spoken today principally in the Arab countries of the Middle East (Egypt, Iraq, Jordan, Lebanon, Saudi Arabia, and Syria), in north Africa, and in large parts of the African continent.
2. South Arabic, the ancient inscripational dialects of South Arabia (such as Minaean, Sabaeen); and modern South Arabic, which includes the dialects spoken on the islands of Socotra and Mahra. Several languages of Ethiopia form a subgroup of ancient South Arabic; these are Geez, the medieval literary language of Abyssinia (now Ethiopia), and several modern Ethiopic languages such as Amharic, Harari, Tigre, and Tigrinya.

Influences. Of all the Semitic language groups, Babylonian-Assyrian provides the most ancient literature; see BABYLONIAN LANGUAGE AND LITERATURE. The Aramaic group is distinguished by the large number of its subdivisions and by the comparatively large territory over which these subdivisions were spread at an early period. The area in which Aramaic prevailed was almost coextensive with the total range of Semitic speech. See BIBLE; SYRIAC LANGUAGE AND LITERATURE; TARGUM.

Of the closely related Hebrew and Phoenician language groups the Hebrew is decidedly most important. See HEBREW LANGUAGE; PHOENICIAN LANGUAGE.

The chief representative of the southern branch of the Semitic languages is Arabic, which has far exceeded all other Semitic tongues in the breadth of its influence. See ARABIC LANGUAGE AND LITERATURE.

Ethiopian literature composed in the dead Geez language dates from the introduction of Christianity into Ethiopia in the 4th century A.D., is almost exclusively religious, and consists mainly of devotional verse, homilies, and lives of the saints.

See also SEMITES. For further information on branches and subgroups of specific Semitic languages see separate articles on those mentioned but not cross referenced in this article.

SEMMELEWEIS, Ignaz Philipp (1818–65), Hungarian obstetrician, born in Buda (now part of Budapest), and educated at the universities of



Ignaz Philipp Semmelweis

Bettmann Archive

Pest (now in Budapest) and Vienna. While working as assistant professor in the maternity ward of the Vienna general hospital, he discovered a relationship between the incidence of puerperal fever (q.v.), which caused many deaths among patients in lying-in wards, and examination by student doctors. The fever was prevalent in wards in which patients were examined by students who had only perfunctorily washed their hands immediately after working in the dissecting room. He further observed that the symptoms of a colleague who had died from the infection of a cut received during a dissection were the same as those of women who had died of puerperal fever; he concluded that puerperal fever was septic and contagious. By rigidly enforcing antiseptic measures, such as washing the hands with chlorinated lime before examining patients, Semmelweis reduced the maternal mortality rate due to puerperal fever at the Vienna general hospital from 12.24 percent to 1.27 percent in two years. Semmelweis nevertheless encountered great opposition from his colleagues in Vienna and went to the University of Pest, at which in 1850 he became professor of obstetrics. During his six years of service at Pest the maternal mortality rate at the university hospital due to puerperal fever was reduced to 0.85 percent. Semmelweis then went into private practice, but his health was undermined by the continued failure of his medical colleagues to accept the findings of his pioneer work in antiseptics in surgery. He died of a septic disease caused by a cut on his hand. His greatest work is *Die Ätiologie, der Begriff, und die Prophylaxis der Kindbettfiebers* ("The Causes, Understanding, and Prevention of Childbed Fever", 1861). **SEMMERING PASS**, mountain pass of Austria, in the Eastern Alps, about 50 miles s.w. of Vienna, and 3215 ft. above sea level. The Semmering railroad passes through a tunnel 1 mi. long, 275 ft. below the summit. The first moun-

tain railroad in the world, it went into operation immediately after the tunnel was completed in 1854.

SEMMES, Raphael (1809–77), American naval officer, born in Charles County, Md. He distinguished himself in the Mexican War (q.v.) as a commander in the United States Navy. In 1861, at the outbreak of the American Civil War, he resigned his commission and joined the Confederate navy. He was commissioned as commander of the converted packet steamer *Sumter*, with which he caused great damage to U.S. merchant shipping, mainly off the coast of South America. In 1862 he assumed command of the warship *Alabama*, and he executed many daring raids until his ship was sunk by the U.S.S. *Kearsarge* off Cherbourg, France, in 1864. Returning to America, Semmes was appointed rear admiral of the Confederate fleet on the James R., in Virginia, until the end of the war. His books include *Memoirs of Service Afloat During the War Between the States* (1869). See CIVIL WAR, THE AMERICAN.

SEMPACH, town of Switzerland, in Lucerne Canton, 7 miles N.W. of Lucerne (Luzern), on the E. shore of the Lake of Sempach. The town is famous as the site of a decisive battle in the Swiss struggle for independence from Austrian rule, won on July 9, 1386, by the confederated Swiss over Leopold III, Duke of Austria (1351–86); see SWITZERLAND: *History*. Pop. (est.) 1275.

SENATE OF THE UNITED STATES. See CONGRESS OF THE UNITED STATES: *The Senate*.

SENDAI, city in Japan, and capital of Miyagi Prefecture, on the E. coast of the island of Honshu, 190 miles N.E. of Tokyo. The city is important as a trading center for salt and fish. The principal industries include the manufacture of beer, silk, pottery, and lacquer ware. Sendai is the seat of Tohoku Imperial University, founded in 1907, and the Industrial Art Research Institute, founded in 1928. Of cultural interest in the city are the ruined 17th-century castle on Aoba Hill, the Rinnoji horticultural park, and the Osaki Hachiman shrine, that has been designated a national treasure. Matsushima, an island that is one of the classical scenic sites of Japan, is 11 mi. from Sendai. Pop (1970) 545,000.

SENECA, Lucius Annaeus (4 B.C.?–65 A.D.), Roman philosopher, dramatist, and statesman, known as Seneca the Philosopher, born in Cordoba, Spain, and educated in Rome. He was the son of the Roman rhetorician Marcus (Lucius) Annaeus Seneca (54 B.C.?–39 A.D.), known as Seneca the Elder or Seneca the Rhetorician. Lucius Annaeus Seneca received thorough training in rhetoric and philosophy, and he was deeply in-

fluenced by the teachings of the Stoics (see STOICISM), whose doctrines he later developed. In 49 A.D. Seneca was made a praetor (q.v.) and appointed tutor to Nero, the son of the Roman emperor Claudius (qq.v.). Upon the death of Claudius in 54, Nero became emperor, and much of the decency and moderation of the first five years of his rule, the so-called *quinquennium Neronis*, was the result of the sane



Seneca

guidance of Seneca and Sextus Afranius Burrus (d. 62 A.D.), Roman commander of the Praetorian Guard. By 62, however, Seneca had lost all control over the emperor. The great wealth that Seneca had amassed aroused the jealousy of Nero, who attempted unsuccessfully to have him poisoned. Seneca, by this time in retirement, devoted himself to philosophical study and writing. In 65, however, he was implicated in a conspiracy to kill Nero, led by Roman plebeian Gaius Calpurnius Piso (d. 65 A.D.), and he committed suicide by imperial order.

The Influence of his Works. Seneca was one of the most eminent writers of the so-called Silver Age of Latin literature and well represents the artificial and epigrammatic style of the period; see LATIN LITERATURE: *The Silver Age*. His orations and several scientific works are lost, but his extant writings are numerous and include the *Apocolocyntosis Divi Claudii* ("The Pumpkinification of the Divine Claudius",

SENECA INDIANS

about 54 A.D.), an amusing but unkind satire on the deification of Claudius; seven books of *Quaestiones Naturales*, dealing with meteorology and astronomy (qq.v.), but also drawing moral lessons and attacking luxury and immorality; *Epistulae ad Lucilium* (63-64), 124 letters addressed to a friend; and several Stoic treatises on subjects such as anger (41-44), tranquillity of mind, and philosophical retirement (55-56). Seneca also wrote nine tragic dramas in verse that are all free adaptations of ancient Greek legends; see **DRAMA: Roman Drama**.

Seneca is considered one of the outstanding Stoic philosophers of Rome; his interests were chiefly ethical, but his beliefs were more spiritual than those of the earlier Stoics. His verse tragedies exerted a profound influence upon the history and development of tragic drama in Europe when they were revived during the Renaissance (q.v.). Later dramatists were attracted to Seneca by his ornate and rhetorical style, his regularity of form, his sensational themes of crime, horror, and revenge, his reflective and introspective qualities, and the Stoic fatalism of his characters. Seneca's tragedies exerted an inestimable influence upon Italian and French classical drama during the Renaissance, and upon English tragedy of the Elizabethan period (see **ENGLISH LITERATURE**). At least one of his plays, *Oedipus*, has been produced successfully in modern times.

SENECA INDIANS. See **IROQUOIS**.

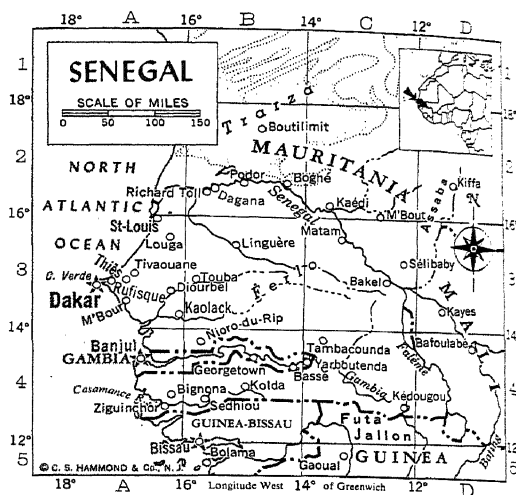
SENECA LAKE. See **FINGER LAKES**.

SENEGAL, river in w. Africa, forming the boundary between the republics of Senegal and Mauritania. The river is about 1000 mi. in length. It has two main sources, the Bafing and the Bakhoi, which meet at Bafoulabé, in Mali. From there the Senegal flows n.w., w., and s.w., reaching the Atlantic Ocean near Saint-Louis, Senegal. The river is navigable from the Atlantic Ocean to Podor, Senegal, all year long, and to Kayes, Mali, during the rainy season.

SENEGAL, REPUBLIC OF, republic in West Africa, bounded on the n. by Mauritania, on the e. by Mali, on the s. by Guinea and Guinea-Bissau, and on the w. by the Atlantic Ocean. The Gambia forms an enclave along the Gambia R. extending into Senegal from the Atlantic a distance of about 200 mi. Senegal lies approximately between lat. 12°20' N. and lat. 16°40' N. and between long. 11°20' W. and long. 17°30' W. The total area is about 76,080 sq.mi.

THE LAND

Most of Senegal is an undulating plain, only rising above 1500 ft. in the s.e., at the foothills of the Futa Jallon Mts. The main rivers are the Sen-



INDEX TO MAP OF SENEGAL

Cities and Towns

Bakel	.....	C 3	Rufisque	.....	A 3
Bignona	.....	B 4	Saint-Louis	.....	A 3
Dagana	.....	B 2	Sedhiou	.....	B 4
Dakar (cap.)	.....	A 3	Tambacounda	.....	C 4
Diourbel	.....	B 3	Thiès	.....	A 3
Kaolack	.....	B 3	Tivaouane	.....	A 3
Kédougou	.....	D 4	Touba	.....	B 3
Kolda	.....	B 4	Ziguinchor	.....	A 4
Linguère	.....	B 3			
Louga	.....	A 3			
Matam	.....	C 3			
M'Bour	.....	A 3			
Nioro-du-Rip	.....	B 4			
Podor	.....	B 2			
Richard Toll	.....	A 2			

Physical Features

Casamance (river)	.....	A 4
Falémé (river)	.....	D 4
Ferlo (region)	.....	B 3
Gambia (river)	.....	C 4
Senegal (river)	.....	B 2
Verde (cape)	.....	A 3

egal, Saloum, Gambia, and Casamance, all of which are navigable in the lower courses. Senegal has a tropical climate with a dry season from November to June and a wet season from June to October. Annual rainfall varies from more than 55 in. in the s. to less than 15 in. in the n.

Natural Resources. Resources are predominantly agricultural. Mineral resources include aluminum phosphate and calcium phosphate. The southern section has mangrove swamps, oil palms, and heavy stands of mahogany, teak, and bamboo. Elsewhere, the vegetation consists of savanna grass, with scattered clumps of trees and spiny shrubs. The lion, leopard, and hippopotamus are numerous.

THE PEOPLE

The population is almost entirely black African. The main ethnic groups are the Fula (q.v.), Wolof, Serer, and Tukulor.

Population and Political Divisions. The population of Senegal (1961 census) was 3,109,840; the United Nations estimated (1975) 4,140,000. The overall density was 55 per sq.mi. (U.N. est. 1974), but most of the population is concentrated in the w. and central regions. The popula-

tion includes about 50,000 foreigners, mainly Europeans, Syrians, and Lebanese.

Principal Cities. The main cities are Dakar (q.v.; pop., 1971, 581,204), the capital, and Kaolack (96,238), Thiès (90,456), Saint-Louis (81,204), and Rufisque (48,101).

Religion and Language. About 76 percent of the population is Muslim, and about 14 percent follow traditional animist beliefs. About 10 percent of the population is Christian, mainly Roman Catholic. French is the official language. Wolof is the most widely understood among the numerous African languages.

Education. Education is based on the French system (see FRANCE: *The People: Education*), and in theory is compulsory for all children between the ages of six and fourteen. About 50 percent of the school-aged population were attending school in the mid-1970's. The University of Dakar, founded in 1957, has a noted research institute for studies of Black Africa.

Culture. The best-known aspect of Senegalese culture is the love of poetry. French influences are very strong. Léopold Sédar Senghor (q.v.), president of Senegal, is a distinguished poet and philosopher.

THE ECONOMY

Although overwhelmingly agricultural, Senegal has a growing industrial sector. Since the end of World War II France has provided substantial technical and economic assistance, largely on a grant basis, and important assistance has been provided by the European Economic Community (q.v.) and by the World Bank. Recent annual budget figures balanced revenues and expenditures at approximately \$250,000,000.

Agriculture. Agriculture occupies about 87 percent of the population. Senegal is among the world's largest producers of peanuts, which account for about 35 percent of the export earnings, while peanut-oil mills provide 40 percent of the industrial turnover. The bulk of the peanut crop is bought by France. Attempts are being made to diversify the economy. Annual production in the mid-1970's included some 760,000 tons of groundnuts, 580,000 tons of millet, 138,000 tons of manioc, and 70,000 tons of rice.

Mining and Manufacturing. Phosphates are the principal mineral product of Senegal. In the mid-1970's annual output included about 1,533,000 tons of lime phosphate. Industrial production in the mid-1970's included about 129,000 tons of peanut oil and about 296,000 tons of cement. A major proportion of the country's continuing five-year plan is devoted to the further expansion of the industrial sector.

Commerce and Trade. The unit of currency in Senegal is the C.F.A. franc (233.5 C.F.A. francs equal U.S.\$1; 1976). Exported goods in the mid-1970's amounted to about \$360,000,000 annually, and imported goods to about \$449,000,000. The chief exported products included peanut oil and oilcake, phosphates, and fish.

Transportation and Communications. The two main rail lines connect Dakar with Saint-Louis on the Senegal R. and with Mali. One road crosses Gambia, linking the N. and S. parts of Senegal. Domestic and regional shipping trade is centered at the port of Dakar. Submarine cables connect Dakar with Europe and with other major cities of W. Africa.

GOVERNMENT

Under the 1970 constitution, Senegal's chief executive is a president, who is popularly elected to a renewable five-year term. The president appoints a cabinet, headed by a prime minister. Legislative power is vested in a unicameral parliament, the 100-member National Assembly, whose members are elected to five-year terms. The leading political party in the country is the Union Progressiste Sénégalaise (U.P.S.).

HISTORY

Remains of Paleolithic and Neolithic civilizations have been discovered by archeologists in

Bassari tribesmen in colorful dress perform at a celebration in Dakar.



SENEGAL, REPUBLIC OF

the region now occupied by Senegal. About 500 A.D. Wolof and Serer peoples entered the country from the N.E. In the 9th century Tukulor settled in the Senegal R. valley, and the powerful Tekrur state of the Tukulor dominated E. Senegal from the 11th to the 14th century. In the 15th century the Wolof established the decentralized Jolof empire near the coast, and it lasted into the 19th century.

Hanno (q.v.), a Carthaginian navigator, seems to have visited the coast of Senegal in the early 5th century B.C., and subsequently commercial ties between the coast and the Mediterranean world may have been established. Modern trade links between Senegal and Europe were forged after Portuguese explorers reached the mouth of the Senegal R. and Cape Verde in 1444-45 A.D. The Portuguese exchanged cloth and metal goods for gold dust, gum arabic, and ivory.

Around 1600 the Portuguese were displaced by the Dutch and French, and by 1700 the French dominated trade along the coast. As director of the Royal Company of Senegal from 1697 to 1720, André Brûe extended French influence far into the interior. But most Franco-African trade continued to be handled by African middlemen, who brought goods to the French settlements at the coast. Following Brûe's departure French activity declined, partly because of the growth of the Fula state of Futa Toro along the lower Senegal R.

Under Captain Louis Faidherbe (1818-89), who was governor of Senegal from 1854 to 1865 (except for 1862), French control of the interior was forcefully extended and consolidated. In 1895 Senegal officially was made a French colony, administered from Saint-Louis. In 1902 government headquarters were shifted to Dakar, which was also the capital of French West Africa (q.v.). Under the French, Senegal's economy was developed around the cultivation of peanuts for export.

Along with French residents, the black Africans of Saint-Louis and Gorée (an island near Dakar) had elected a deputy to the French National Assembly during 1848-52 and again after 1871, when they were joined by the inhabitants of Dakar and Rufisque. (Later, in 1946, citizens of the entire colony were enfranchised.) In 1914 the first black African, Blaise Diagne, was elected to the French parliament, and he served until 1934. After World War II a territorial assembly was established in Senegal, and politics in the colony were dominated by Lamine Guèye (1891-1968) and Léopold Sédar Senghor (q.v.).

In 1958 Senegal was granted almost complete internal autonomy, and in June, 1960, it became

fully independent as part of the Mali Federation, which joined Senegal with the Sudanese Republic (now Mali). On Aug. 20, 1960, Senegal withdrew from the federation and became a separate republic. Senghor was elected the first president of Senegal; he was reelected in 1963, 1968, and 1973. Following an alleged coup d'état attempt in 1962 by Prime Minister Mamadou Dia (1910-), the powers of the president were greatly increased under a new constitution that went into effect in 1963. Presidential power was reduced somewhat by the constitution of 1970, but Senghor remained the dominant figure in Senegalese political life. Under his regime the country made progress in diversifying its economy, but income from foreign sales of peanuts remained crucial. At times, notably in 1968 and 1973, students staged large demonstrations to protest the concentration of power in Senghor's hands.

SENGHOR, Léopold Sédar (1906-), Senegalese political leader and poet, born in Joal, French West Africa (now Senegal), and educated at the University of Paris. He began teaching (1935) in a lycée, or secondary school, in Tours, France. During World War II he served in the French army and was captured by the Germans, who held him prisoner from 1940 to 1943. After his release Senghor taught in a Paris lycée (1944-48) and at the National College of France Overseas, in Paris (1948-58).

Senghor became active politically shortly after the war. First elected to the general council of Senegal in 1946, he worked consistently for Senegalese independence. Senghor served simultaneously (1946-58) as a Socialist Party deputy for Senegal in the French National Assembly. In 1960 Senghor became the first president of Senegal; see **SENEGAL, REPUBLIC OF: History**.

Called Africa's leading intellectual, Senghor has published poetry and articles on both literature and politics. His first volume of poetry, *Chants d'Ombre* ("Shadow Songs"), was published in Paris in 1945 to critical acclaim. Four volumes of poetry in French, eloquent expressions of black African life, followed. Among the works of Senghor published in English are *Selected Poems* (1964), *On African Socialism* (1964), and *Prose and Poetry* (1965). See also **AFRICAN LITERATURE: Contemporary Literature**.

SENILITY. See **GERIATRICS**.

SENIORITY SYSTEM, in government and in labor-management relations in the United States, policy, either traditional or explicit, whereby seniority and its prerogatives are accorded an official or employee on the basis of continuous service.

United States Congress. A seniority system is traditional in the United States Congress, where it determines the relative status of a Representative or Senator in respect to important committee appointments; see CONGRESS OF THE UNITED STATES. Although the system, also known as the seniority rule, is not a formal, written regulation, it is rarely violated in either House of Congress. It has been observed in the United States Senate since 1846 and in the United States House of Representatives since 1910. Under the system, each member of Congress has priority for a committee position, and certain other prerogatives, solely or principally on the basis of his length of service on a committee or in his House. Ordinarily, a committee member, once appointed, may not be removed without his consent. Within committees themselves, the extremely important and influential chairmanships are also determined by seniority principles.

A typical example of the seniority system at work is the practice of appointing as committee chairman, in either House, the majority-party member with the longest continuous tenure on that committee. Assigned first to the bottom of his party's list on a committee, the member moves upward as those above him die, retire, resign, or are defeated for reelection. Custom further dictates that a committee chairman may not be deposed without his consent unless his party loses its majority; in that case, the most senior committee member from the opposing party succeeds to the chair. A member of Congress may head only one standing committee; if eligible for another chairmanship, he is usually given his choice between them.

Very senior or long-standing members of a committee tend to dominate its subcommittee chairmanships, especially in the House of Representatives. Senior committee and subcommittee members are customarily appointed to so-called conference committees. Length of service in one's chamber is also taken into account in appointments to various commissions, allotment of office space and patronage, and protocol matters.

In spite of its general acceptance, there have been cases in which the seniority system has not been observed. In recent years, one committee chairman was removed by House Democrats for alleged misbehavior, and three other Congressmen were stripped of their committee seniority for publicly supporting a Presidential candidate of another party. The seniority system has been criticized by some for the inherent priority it gives to age over personal qualifications; and also because it tends to provide an advan-

tage for representatives from virtually one-party States, who hold so-called safe seats, over those from States that have a higher electoral turnover.

Labor-Management Relations. Outside of the U.S. Congress, the system of seniority is also operative in labor-management relations, where the principle is basic to virtually all collective-bargaining agreements. It provides, in employment policy, that all other things being equal, promotions are to be given to those with the longest record of continuous employment with a given firm. Similarly, if workers must be dismissed as a result of business slumps or budgetary cut-backs, those workers with the least seniority are to be the first released. The seniority principle has been criticized as retarding the advancement of minority-group workers, but few unions or workers have proved willing to surrender the length-of-service protection it affords. See CIVIL RIGHTS AND CIVIL LIBERTIES; LABOR RELATIONS. W.K.

SENLIS, town of France, in Oise Department, on the Nonette R., about 33 miles N.E. of Paris. Senlis is a place of great antiquity, with walls erected in the Gallo-Roman period and a cathedral dating from the 12th century. Pop. (1970) 11,169.

SENNA, common name for the dried leaflets of several species of the genus *Cassia*, used in various medical preparations for purgatives. Alexandria senna, first introduced into Europe by the Arabs, consists of the leaves of *C. acutifolia*, often adulterated with stems and pods of the same plant, and leaves of other plants. Tinivelly, or Indian senna, consists of the leaves of *C. augustifolia*; the leaflets are larger and finer than those in the Alexandria senna, and are rarely adulterated. A common laxative preparation of senna, called black draft or black dose, includes Epsom salt (q.v.) extract of licorice. See CASSIA.

SENNACHERIB (r. 705–681 B.C.), Assyrian king, son of King Sargon II (r. 722–705 B.C.). He was the originator of great public works, including the construction of canals and watercourses and the erection of a palace at Nineveh. For the principal events of his reign, see ASSYRIA.

SENNETT, Mack (1884–1960), American motion-picture producer and director, born Michael Sinnott in Danville, Québec Province, Canada. Sennett started his career working with the noted film director David Wark Griffith (q.v.). In 1901 he joined the staff of Biograph Studio. Between 1910 and 1929 Sennett made more than 1000 silent motion pictures. Sennett introduced slapstick comedy to American mo-

SENSATION

tion pictures. His films often included groups of beautiful young women, who came to be known as Sennett Girls. Sennett directed most of the famous silent-film comedians, including Charlie Chaplin, W. C. Fields, and Buster Keaton. He also created the famous Keystone Kops, a group of comical policemen who were featured in a series of short films.

SENSATION. See **PSYCHOLOGY**; **EXPERIMENTAL**.

SENSES. See **SPECIAL SENSES**.

SENSITIVE PLANT. See **MIMOSA**.

SENTENCE, group of words expressing a complete thought. See **GRAMMAR: Parts of Speech**; **SYNTAX**.

SENTENCE, judicial penalty. See **CRIMINAL PROCEDURE**; **PENOLOGY**; **PUNISHMENT**.

SENUSSI. See **SANUSI**.

SEOUL, or **KYŎNGSŎNG** (Jap. *Keijo*), capital and largest city of the Republic of Korea, on the Han R., about 20 miles N.E. of Inch'ŏn, its port on the Yellow Sea. The city is served by several railroads and an international airport is nearby. In the surrounding agricultural region apples, rice, soybeans, and wheat are grown. A financial and cultural center, the city also has plants producing foodstuffs, leather goods, and textiles. Cultural centers include academies of arts and sciences, several libraries and museums, and nine universities. Landmarks include a bell tower containing a bronze bell inscribed with the date 1468, and remnants of a stone wall, which once encircled the city. Much of the city was rebuilt after the Korean War (q.v.).

Founded in 1392, Seoul served as the seat of government until 1910, when the country was annexed by Japan. The city became the capital of the Republic of Korea in 1948. Seoul was captured by North Korean troops twice during the Korean War of 1950-53. Pop. (1970) 5,536,377.

SEPAL. See **FLOWER: Types of Flowers**.

SEPARATION, in the law of domestic relations in Great Britain and the United States, either a separation agreement, that is, a contract entered into between husband and wife by which they agree to live apart; or a judicial separation, a court decree which separates the parties to the marriage and provides for their living apart. Separation does not dissolve the marriage relationship. See **HUSBAND AND WIFE**. Compare **DIVORCE**.

Separation agreements are commonly entered into when the husband and wife have separated or contemplate an immediate separation because of incompatibility. The separation agreement signed by the parties generally contains provisions for the maintenance of the wife and the husband as well as for a division of property. Although separation agreements also

provisions for the custody and support of children, a court always has the power to change those provisions for the best interests of the children. An agreement that provides for a future separation is illegal and void as against public policy. A reconciliation between husband and wife after they have separated voids the separation agreement.

A judicial separation is obtained by an action for separation instituted by the husband or wife against the other. The grounds for such an action, fixed by statute, are generally abandonment or desertion, failure of the husband to provide financial support, cruel and inhuman treatment, or such conduct as may render it unsafe for the plaintiff to cohabit with the defendant. In general, an action for separation cannot be instituted while a separation agreement is in force; a wife may, however, bring such an action if the agreement has been breached by the husband. The defendant may allege as a defense the misconduct of the plaintiff, and if the defense is established the judgment is entered in favor of the defendant. The separation decree provides for alimony for the wife and support and custody of the children. A separation decree may be revoked by court if both spouses apply and can prove their reconciliation.

SEPARATION OF POWERS, concept of government in the United States whereby power is divided among the executive, judicial, and legislative branches. See **CONSTITUTION OF THE UNITED STATES: The Constitutional Convention**; **UNITED STATES OF AMERICA, THE: Government**.

SEPARATISTS, in religious history, two main groups of dissenters from orthodox church bodies.

Separatists. In the history of the Church of England (q.v.), some of those who withdrew during the 16th and 17th centuries were known as Separatists. They were dissatisfied with the ritual used in worship and with the state control of religion in England. The English clergyman Robert Browne (q.v.) was influential among these Separatists, and his followers came to be known as Brownists (q.v.). His writings contain perhaps the earliest statement of Congregational principles; see **CONGREGATIONALISM**. In the 17th century the Separatists became known as Independents; their congregational system was brought to America by the Pilgrim Fathers (q.v.). See also **DISSENTERS**; **NONCONFORMISTS**.

Separatists of Zoar. The 19th-century American sect of the Separatists of Zoar is discussed under **ZOAR, SEPARATIST SOCIETY OF**.

SEPHARDIM (pl., **SEPHARDIM**), member of the Jewish community. Originally the term meant a Jew

who lived in western Europe, particularly Spain or Portugal, during the medieval period, or a descendant of such a Jew. In modern Israel, the Sephardim are usually of Asian or North African background. See also INQUISITION; ISRAEL: *The People*; JEWS: *Postexilic Jews*; *Jews in Modern Life*; PRAYER, JEWISH. Cf. ASHKENAZI.

SEPOY MUTINY. See INDIAN MUTINY.

SEPTEMBER, ninth month of the Gregorian calendar (q.v.). It was the seventh month of the Roman calendar and takes its name from the Latin word *septem* meaning seven. September has thirty days. The first Monday of the month is Labor Day, celebrated in honor of the workingman and observed as a holiday in all States, the District of Columbia, and territories of the United States.

SEPTICEMIA, condition of the blood caused by the presence and multiplication of bacteria in the bloodstream. The bacteria may enter the bloodstream from an infected area of the body or after an injury or a surgical procedure. Septicemia is characterized by chills, fever, prostration, and infections of the internal organs. The condition, called bacteremia if the bacteria is short-lived in the bloodstream, is generally regarded as synonymous with blood poisoning. Septicemia is treated with an antibiotic or chemotherapy (qq.v.). Compare TOXEMIA.

SEPTIC TANK. See SEWAGE DISPOSAL: *History*; *Septic Tank*.

SEPTUAGINT. See BIBLE: *The Growth of the Bible*; BIBLE SCHOLARSHIP: *Textual Criticism*.

SEQUENCE AND SERIES, in mathematics, ordered succession of numbers or other quantities, and the indicated sum of such a succession, respectively.

A sequence is represented as $a_1, a_2, \dots, a_n, \dots$. The a 's are numbers or quantities, distinct or not; a_1 is the first term, a_2 the second term, and so on. If the expression has a last term, the sequence is finite; otherwise, it is infinite. A sequence is established or defined only if a rule is given that determines the n th term for every positive integer n ; this rule may be given as a formula for the n th term. For example, the positive integers from 1 to 20 in natural order form a finite sequence. All the positive integers, in natural order, form an infinite sequence. The formula $a_n = n^2$ determines the sequence 1, 4, 9, 16, \dots . The rule of starting with 0, 1, then letting each term be the sum of the two preceding terms determines the sequence 0, 1, 1, 2, 3, 5, 8, 13, \dots ; this is known as the Fibonacci sequence (or series).

An arithmetic sequence or progression (see ARITHMETIC PROGRESSION) is the sequence $a, a +$

$d, a + 2d, a + 3d, \dots$, obtained by starting with an arbitrary number a and adding to it an arbitrary but fixed amount d , called the common difference, to get the next term. The n th term of an arithmetic progression, with first term a and common difference d is denoted by a_n and is given by the formula $a_n = a + (n - 1)d$; the sum of the first n terms is: $S = \frac{1}{2}n(a + l)$, in which l is the last, or n th term. If no term of an arithmetic progression is 0, and each term is replaced by its reciprocal, the result is called a harmonic progression.

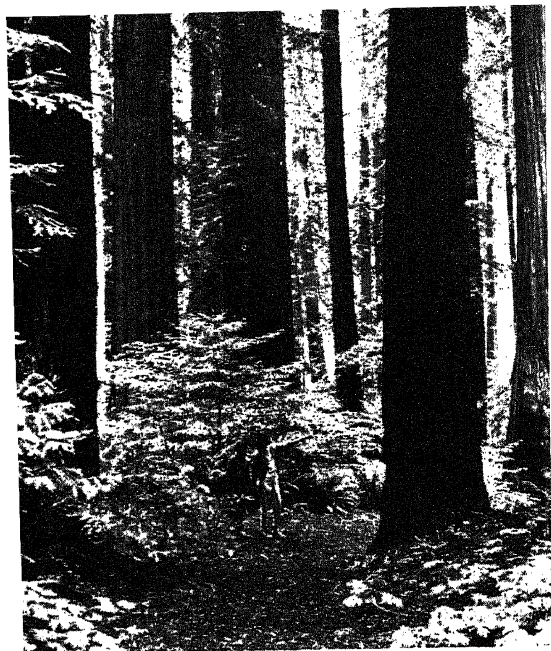
A geometric sequence or progression (see GEOMETRIC PROGRESSION) is the sequence $a, ar, ar^2, ar^3, \dots, ar^n, \dots$, obtained by starting with an arbitrary (nonzero) number a and multiplying it by an arbitrary but fixed (nonzero) number r , called the common ratio, to get its successor. The n th term of a geometric progression with first term a and common ratio r is given by the formula $a_n = ar^{n-1}$. The sum of the first n terms is $S = a \frac{(1 - r^n)}{(1 - r)}$, if $r \neq 1$; if $r = 1$, $S = na$.

If a_1, a_2, a_3, \dots is a given sequence, a number L may exist with the property that for any arbitrary, preassigned positive number ϵ , each and every term of the sequence beyond a certain point (dependent on ϵ) will differ numerically from L by an amount less than ϵ . If such an L does exist, the sequence is said to be convergent, or to converge to L . If no such number L exists, the sequence is said to be divergent.

The term "series" is frequently used both as a synonym for the word sequence and as the name of the indicated sum, $a_1 + a_2 + \dots + a_n$, or $a_1 + a_2 + \dots + a_n + \dots$, of the terms of a sequence. Properly, the word "series" should be restricted to the second sense. In that sense, a series is finite or infinite, depending on whether the corresponding sequence of terms is finite or infinite.

The sequence $s_1 = a_1, s_2 = a_1 + a_2, s_3 = a_1 + a_2 + a_3, \dots, s_n = a_1 + a_2 + \dots + a_n, \dots$, is called the sequence of partial sums of the series $a_1 + a_2 + \dots + a_n + \dots$. The series converges or diverges as the sequence of partial sums converges or diverges. A constant-term series is one in which the terms are (arbitrary) numbers; a series of functions is one in which the terms are (arbitrary) functions of one or more variables. In particular, a power series is the series $a_0 + a_1(x - c) + a_2(x - c)^2 + \dots + a_n(x - c)^n + \dots$, in which c and the a 's are constants.

The theory and application of infinite series are of extreme importance in virtually every branch of pure and applied mathematics. J.Si.



Coast redwoods, *Sequoia sempervirens*

Redwood Empire Assn.

SEQUOIA, group of huge, majestic evergreen trees of the cypress family, characterized by a columnar, reddish-brown trunk rising 100 ft. (30 m) or more above a buttressed base, conical-shaped foliage, needlelike leaves extending below the stems, and small, oval cones. The tree is named in honor of the Cherokee leader Sequoyia (q.v.).

Once abundant throughout the north temperate regions of the world, most sequoias suffered extinction with the advancing ice sheets of the glacial epoch (see QUATERNARY PERIOD). Only three genera remain in very restricted areas: the giant sequoia and coast redwood in California and the dawn redwood in southwestern China. The Petrified Forest of Arizona consists largely of extinct sequoia species. Fossil remains of sequoia trees have been found in geological strata as old as the Jurassic (see JURASSIC PERIOD).

Giant Sequoia. The giant sequoia, or "big tree", *Sequoiadendron giganteum*, is found in a narrow strip 200 mi. (322 km) long on the western slopes of the Sierra Nevada range at elevations between 3000 and 8000 ft. (900 to 2440 m). It is the most massive and one of the oldest of all living forms. The largest specimen, the General Sherman Tree in Sequoia National Park (q.v.), is 272 ft. (83 m) high, 36.5 ft. (11 m) in diameter above the flaring base, and weighs about 2150 tons (1,950,450 kg). Other trees range from 150 to 325 ft. (46 to 99 m) in height, with diameters up to 30 ft. A count of annual rings on stumps has verified ages as great as 2300 years.

Some living trees, however, are believed to be close to 4000 years old, an age exceeded only by the bristlecone pine, one living specimen of which was dated at 4900 years. The leaves of the giant sequoia are scalelike and lie close to the branches. The bark of the trunk is fluted and is spongy in texture; in large trees it reaches a thickness of 2 ft. (0.6 m). The wood is light, coarse-grained, and highly resistant to insects and fire. Most of the giant sequoia groves are included within the National Park System or are otherwise under government protection; cutting of the big trees is prohibited.

Coast Redwood. The coast redwood, *Sequoia sempervirens*, grows along the humid Pacific coast from southern Oregon to central California. Its height ranges from 100 to 385 ft. (30 to 117 m), a size approached only by the eucalyptus (q.v.) of Australia, a specimen of which measures 326 ft. (99.4 m). The diameter of the trunk measures up to 25 ft. (7.5 m). The life span of the coast redwood is believed to be 2500 years. The leaves are bluer in tone than the giant sequoia and are more needlelike. The wood is similar but even-grained. Unlike most other conifers (cone-bearing trees), the stump produces sprouts after cutting; these grow in forty years to a size suitable for lumbering. For this reason, and because the tree is more plentiful than the giant sequoia, it has been cut extensively. Some of the old-growth, irreplaceable specimens are now preserved in State and national parks.

Dawn Redwood. The dawn redwood, *Metasequoia glyptostroboides*, was at one time the most common sequoia tree in North America and is thought to be ancestral to the California redwood. It attains a height just under 100 ft. (30 m) and averages 6 ft. (1.8 m) in diameter. Its leaves are flat and grow on slender, opposite branches. They shed annually. The dawn redwood was thought to be extinct until a few living specimens were found in China in 1944. Seeds and seedlings collected in 1948 by the Arnold Arboretum in Massachusetts have been successfully propagated in California and elsewhere in North America.

Classification. The sequoia trees are in the class Pinopsida, order Coniferales, family Taxodiaceae. See CONIFER.

SEQUOIA NATIONAL PARK, area of natural interest in California, north of San Francisco, in the Sierra Nevada Mts. The park was established in 1890 to preserve groves of giant sequoia (q.v.) trees; it contains many thousands of seedlings and several hundred old-growth trees. Perhaps the most spectacular feature of the park is the General Sherman Tree, the largest living thing in

the world. Other noted sites are the 14,494-ft. (4418-m) Mount Whitney (q.v.), the Kern River Canyon, and Crystal Cave. Scenic landscapes and wildlife are abundant. On the north and adjacent to the park is Kings Canyon National Park (q.v.); both parks are administered as one unit by the National Park Service (q.v.).

SEQUOYA or **SEQUOYAH**, or **GEORGE GUESS** (1770?-1843), American Indian leader, inventor of the Cherokee alphabet, born in the Cherokee village of Taskigi in Tennessee, the son of a white trader and a part-Cherokee woman. Adopting the English name of George Guess, presumably after his father, who is thought to have been called Nathaniel Gist, Sequoya worked as a silversmith and a trader in Cherokee County, Ga. He developed a Cherokee alphabet, composed of eighty-five characters, for his tribal language and succeeded in teaching thousands of Cherokee to read and write. The giant sequoia (q.v.) trees and the Sequoia National Park (q.v.) in California are named after him. See also **CHEROKEE**.

SERAO, Matilda. See **ITALIAN LITERATURE: The 20th Century**.

SERAPHIM (Heb., "burning ones"), celestial beings referred to in a vision by the Hebrew prophet Isaiah (Isa. 6:2-6) in the Old Testament and considered to be the highest in the order of angels; see **ANGEL**.

SERAPIS, British ship taken by the American naval officer John Paul Jones (q.v.) during the American Revolution in a naval battle that began at sundown on Sept. 23, 1779, and continued by moonlight for over three and a half hours. See also **BONHOMME RICHARD**.

SERAPIS, or **SARAPIS**, in the mythology of Greek and Egyptian religion, a deity, variously associated with Osiris, Hermes, and Hades (qq.v.), introduced in the 3rd century B.C. as a state god for both Greeks and Egyptians. Serapis was believed by Egyptians to be a human manifestation of Apis (q.v.), a sacred dead bull that symbolized Osiris; in Greek mythology, Serapis was represented as a god of fertility and medicine and the ruler of the dead in Tartarus (q.v.). The worship of Serapis spread throughout the ancient world and the Roman Empire. The cult waned with the ascendancy of Isis (q.v.), the Egyptian goddess of motherhood and fertility, and the destruction of the temple to Serapis in Alexandria in 385 A.D. marked the virtual end of paganism in the Roman Empire.

SERBIA (Serbo-Croatian *Srbija*), constituent republic of the Republic of Yugoslavia, bounded on the N. by Hungary, on the E. by Rumania and Bulgaria, and on the S. by Mace-

donia, on the S.W. by Albania, and on the W. by Montenegro, Bosnia and Hercegovina, and Croatia. Serbia can be divided into three political and geographical regions: the autonomous Vojvodina Province, a large fertile plains area drained by the Danube, Sava, Tisza, and Morava rivers in the N.; Šumadija, the hilly and most populous area, which is in central Serbia; and the autonomous Kosovo Province, a mountainous area in the S. Serbs, a major group of Slavs (q.v.), make up about three quarters of the population. Minorities include Slovenes, Croats, Magyars, and others. Serbo-Croatian (q.v.) is the main language, and a majority of the people are members of the Serbian Orthodox Church. The most important city in the republic is Belgrade, the Yugoslav capital. Other important cities are Novi Sad, Niš, Subotica, Zrenjanin, and Kragujevac. Area, 34,116 sq.mi.; pop. (1971) 8,432,108.

Voyvodina is the most important agricultural area in Yugoslavia. The major crops are wheat, corn, sugar beets, hemp, flax, and fruit. Cattle, sheep, and pigs are also raised. The main industrial activities are copper-ore processing, the extent of this industry making Serbia one of Europe's major copper producers, and the manufacture of textiles, chemicals, and machinery.

History. Serbia was at one time part of the ancient country of Illyria (q.v.) when the Romans conquered it, governing it after 44 A.D. as the province of Moesia. The Goths began attacking the area in the 3rd century, and although Moesia was part of the Byzantine Empire after 395, Goth invaders overran the province in the late 4th century. During the 7th century Serbs settled in the area west of the Morava R., and in the 8th century they organized into political units under zhupans, military and political chiefs who gave allegiance to the Byzantines. In the 9th century control over Serbia was contested by the neighboring Bulgarians, but the Byzantines maintained their rule.

Turkish Control. The Serbs were united by the grand zhupan Stephen Nemanya (r. 1167?-96), who founded the Nemanyich dynasty and established the first kingdom of Serbia. Serbia gradually expanded until, under the leadership of Stephen Dushan (r. 1331-55), it controlled most of what is now Yugoslavia, Albania, and Greece. At the same time, however, the Ottoman Empire was also increasing in power; see **TURKEY: History**. At Kosovo in 1389 the Serbs were decisively defeated by the Ottoman Turks, and, for the next seventy years, Serbian princes were subject to Turkish rule. Sporadic fighting continued until 1459, when the Turks captured

SERBIA

the fortress of Smederevo, south of Belgrade. Serbia then came under direct Turkish rule as a province in the empire.

Finally the Serbs, after 345 years of often brutal subjugation, were reunited under Karageorge, originally named George Petrović (1766?–1817), founder of the Karageorgevich dynasty. Beginning in 1804, they waged a nine-year revolt, but Turkey regained control in 1813. Two years later a second revolt was led by Miloš (1780–1860), founder of the Obrenovich dynasty. Within a few months most of Serbia was free of Turkish domination. Miloš was recognized as hereditary prince of Serbia in 1817, and Serbia was granted limited self-government within the empire. Following victories by Russia, a Serbian ally, against Turkey in the Russo-Turkish Wars (q.v.) of 1828–29, Miloš' status was reaffirmed, Serbia gained greater autonomy, and the number of Turkish garrisons in Serbia was reduced.

Miloš had been implicated in the 1817 assassination of Karageorge. This deed led to an intense rivalry between the two houses, and domestic unrest that lasted until 1903. Miloš was an arbitrary ruler, and was forced to abdicate in 1839 in favor of his eldest son Milan (1819–39), who died shortly thereafter. Milan was succeeded by his brother Michael (1825–68) who was in turn replaced in 1842 by Karageorge's son Alexander (1806–85). Alexander established a civil code and a judicial system, but he was weak and vacillating. He was deposed in 1858, and the Obrenovich dynasty was restored. Michael, ruling for a second time (1860–68), engineered the Turkish evacuation of all Serbian garrisons in 1867, and he planned the unification of the Balkan Peninsula. In 1868, however, he was assassinated, and his young cousin Milan (1854–1901) gained the throne. A regency ruled for Milan, and in 1869 it liberalized the constitution. Milan ascended the throne in 1872, and four years later he supported an anti-Turkish revolt in neighboring Bosnia and Hercegovina, in which the Serbs were badly defeated and withdrew.

Austro-Hungarian Control. During the Russo-Turkish Wars of 1877–78, Serbia and Russia allied to defeat Turkey in the Balkans. The 1878 Congress of Berlin (see BERLIN, CONGRESS OF) recognized Serbian independence, but in effect made the country subservient to the dual monarchy of Austria-Hungary (q.v.). In 1882 Milan, with Austro-Hungarian support, proclaimed himself king, and in 1885 he declared war on Bulgaria (see BULGARIA: *History*). Bulgaria had joined with the Turkish autonomous province

of Eastern Rumelia, and Milan sought not only conquest of the province, but the subjugation of Bulgaria. The Serbs were quickly routed, but Serbia was saved from conquest by Austrian intervention. The Bulgarian fiasco antagonized the powerful Radical Party, a liberal reform group, which in 1889 wrote a more liberal constitution and forced Milan to abdicate.

Milan's son Alexander I Obrenovich (1876–1903), first proclaimed king under a regency, assumed the throne in 1893. His restoration of the 1869 constitution, the general corruption of his government, and his marriage to the unpopular Draga Mašin (1867–1903), all contributed to his unpopularity. In 1903 Alexander and his wife were assassinated.

The Karageorgevich dynastic rule was resumed when the Serbian legislature selected Peter I Karageorgevich (see *under* PETER) as king in 1903. The 1889 constitution was soon restored, and Peter's friend the Serbian statesman Nikola Pašić (1845?–1926), founder of the Radical Party, took control of Serbian foreign policy as premier.

Serbian relations with Austria-Hungary deteriorated badly during the so-called Pig War of 1905–07, a customs dispute, and worsened after 1908 when Austria-Hungary annexed Bosnia and Hercegovina. In 1912 Serbia, Bulgaria, and Montenegro signed mutual defense pacts. The alliances led to war when Montenegro attacked Turkey in October, 1912, in the First Balkan War; see BALKAN WARS. Turkey had been weakened by foreign and domestic strife, and by December, 1912, Turkish rule had been eliminated in Macedonia (q.v.) and Albania. Bulgaria contested the Serbian claim to Macedonia, and Serbia, now allied with Greece, in June, 1913, attacked Bulgaria in the Second Balkan War. By July, 1913, Bulgaria sued for peace, and Greece and Serbia took most of Macedonia. Serbia also received the sanjak, or district, of Novi Pazar and Kosovo-Mitohiyen. Austria-Hungary became alarmed by the growing strength of Serbia in the Balkans.

World War I. Tension was already extremely high on June 28, 1914, when the Austrian archduke and heir to the Austrian-Hungarian throne Francis Ferdinand (q.v.) and his wife were assassinated by a Serbian student, Gavrilo Princip (1893?–1918), at Sarajevo, Bosnia. The dual monarchy, holding Serbia responsible for the assassination, declared war and in August invaded Serbia. Pašić had already ordered military mobilization, and the Serbs repelled the invaders until October, 1915, when Bulgaria invaded Serbia. By December, 1915, Serbia was occupied by

the Central Powers (q.v.), and the Serbian army and government fled to the Greek island of Corfu in 1916. See *WORLD WAR I: The Military Campaigns: The War in Serbia*.

Union with Yugoslavia. The government in exile agreed to the terms of the Corfu Declaration calling for Slavic unity. After the war, in 1918, the leaders of Serbia, Croatia, and Montenegro proclaimed the Kingdom of the Serbs, Croats, and Slovenes, which became the Kingdom of Yugoslavia in 1929.

During World War II, in 1941, the Germans invaded Serbia and established a puppet state. After the Axis defeat, a Yugoslav republic was declared, and Serbia became a constituent republic with limited powers. Kosovo-Mitohiyen (now Kosovo) and Vojvodina were given autonomy within Serbia.

See *YUGOSLAVIA: History*.

SERBO-CROATIAN, member of the southern group of Slavic languages (q.v.) and the major language spoken in Yugoslavia. The existence of long and short vowels along with a pitch accent makes Serbo-Croatian one of the most expressive among the European languages. Serbs and

Croats speak a common tongue, the former calling it Serbian and using the Cyrillic alphabet and the latter calling it Croatian and using the Roman alphabet. See *CROATIA; SERBIA*.

SERENADE (Lat. *serenus*, "serene"; influenced in meaning by It. *sera*, "evening"), music played traditionally by a lover for his sweetheart. The serenade, originally an evening song, as opposed to the aubade or morning song, can be either vocal or instrumental. In vocal music the serenade almost always is for a lover to sing at his lady's window. The instrumental serenade developed during the 18th century and was originally designed for performance outdoors in the evening. It usually consists of a number of short movements such as marches, minuets, and rondos, and resembles the suite (q.v.).

SERFDOM (from Lat. *servus*, "servant, slave"), fundamental institution of the feudal system of society, under which a class of peasants known as serfs worked on and were legally bound to the land owned by their manorial lords; see *FEUDALISM*. The basic relationship between the lord and the serf was characterized by the rendering of dues, in the form of a portion of the

French serfs harvesting grain and shearing sheep outside the Château de Poitiers, the July miniature from Les Très Riches Heures du Duc de Berry.

Bettmann Archive



SERFDOM

crops, and of various forms of service, including military aid, to the lord by the serf. In return, the lord was obliged to protect the serf against depredations by outlaws or other lords. The serfs were generally subject to the will of the lords; when a lord sold his manor the serfs were almost invariably included in the sale. Serfs were required to obtain the lord's permission before offering their daughters in marriage, and in some instances the lord enjoyed the privilege, known as the *droit de seigneur* ("lord's right"), of spending the wedding night with the bride. In some regions the lord was also empowered to inflict capital as well as corporeal punishment on serfs who had committed serious transgressions of the prevailing laws and customs. Serfdom differed from slavery, however, in that the slave was the chattel property of his master and had no legal prerogatives, whereas the serf, while bound to serve the owner of the land, was not legally owned by his master and enjoyed certain legal rights and immunities. The serf might own certain personal property, including draft animals and agricultural implements, which could be bequeathed to his heirs, and by custom he also enjoyed the hereditary privilege of working specified parcels of land within the manor. The rights of the lord were limited by custom in several respects; for example, a lord wishing to give a portion of his land to the Church usually had to obtain the consent of the serfs affected by the proposed gift.

Social institutions closely akin to serfdom were known in ancient times. The status of the helots (q.v.) in the ancient Greek city-state of Sparta resembled that of the medieval serfs, as did the condition of the peasants working on government lands in ancient Rome. These Roman peasants, known as *coloni* "tenant farmers", are generally believed to be the direct precursors of the serfs. The breakup of the Roman Empire about the 9th century A.D. was followed by a long period during which no strong central governments existed in most of Europe; the rise to power of the manorial lords, and the establishment of serfdom as the system whereby the prevailing agricultural mode of production could be carried on, were the natural consequences of the absence of centralized authority.

By the late 16th and early 17th centuries, serfdom had become general throughout Europe; in Russia it had degenerated into a system under which the peasants were theoretically free tenants, but were actually in a state of servitude to, and dependence on, the landowners. Russian serfs were rigorously exploited by the lords, who demanded ever-larger shares of the crops

and thus created a steadily mounting indebtedness on the part of the serfs. By the end of the 17th century the serfs of Russia had become so impoverished, and had given up so many of their former rights, that their status scarcely differed from that of chattel slaves. In many areas of western Europe, however, large numbers of serfs had gradually risen to a degree of economic independence and personal freedom, and had even become small landowners in their own right. Only vestiges of feudalism remained in the 18th century, and the French Revolution (q.v.) of 1789 virtually eliminated serfdom throughout most of western Europe. In eastern Europe, and particularly in Russia, the system persisted until the middle of the 19th century; it was abolished by Alexander II, Emperor of Russia in 1861.

SERGIUS, name of four popes, of whom the following are important historically.

Saint Sergius I (d. 701), pope from 687 to 701, born into a Syrian family and educated in Palermo, Sicily. During his pontificate he supported missions to England and added the singing of the *Agnus Dei* (Lat., "Lamb of God") to the Mass (q.v.). Byzantine Emperor Justinian II (669–711) ordered his arrest in 692 for refusing to sanction certain canons, or regulations, of the Quinisext (Trullan) Council of Constantinople (see CONSTANTINOPLE, COUNCILS OF), but the Romans prevented execution of the order. His traditional feast day, Sept. 9, is no longer included in the Roman Catholic calendar; see SAINT.

Sergius III (d. 911), pope from 904 to 911, born in Rome of a noble family. About 891 he became bishop of Caere (now Cerveteri, Italy); he resigned his see in 896 and the following year made an unsuccessful attempt to seize the papacy. Later, as pope, he established several sees in England. His support of a fourth marriage for Byzantine Emperor Leo VI (866–912) lowered papal prestige.

SERIES. See SEQUENCE AND SERIES.

SERKIN, Rudolf (1903–), American pianist, born in Eger, Austria-Hungary (now Cheb, Czechoslovakia). A child prodigy at four, he studied piano privately in Vienna, making his debut with the Vienna Symphony Orchestra at the age of twelve. After further study he began his career as a concert pianist with a tour of Europe in 1920. An important interpreter of the music of the German composer Ludwig van Beethoven and the Austrian composer Wolfgang Amadeus Mozart (qq.v.), Serkin is noted for his precise and imaginative piano technique.

Serkin made his American debut in 1933 in Washington, D.C., and made the first of his an-



Rudolf Serkin

Columbia Records

nual concert tours of the United States the following year. He became head of the piano faculty at The Curtis Institute of Music, Philadelphia, in 1939. Since the inception in 1950 of the Marlboro music festival and workshop, an annual summer event at Marlboro College, Marlboro, Vt., Serkin has been actively involved as artistic director. He was named director of The Curtis Institute in 1968; later that year he was appointed to the National Arts Council by President Lyndon Baines Johnson. He has also appeared with his son Peter Serkin (1947–) in dual piano concerts.

SERLING, Rod (1924–75), American motion-picture and television writer and producer, born in Syracuse, N.Y. After serving as a paratrooper in World War II, he attended Antioch College, where he began writing radio and television scripts, and was graduated in 1950. He first achieved national recognition for his television play *Patterns* (1955), a drama about corporation executives. *Patterns* was made into a motion picture the following year. Serling was one of television's most prolific writers during the 1950's and 1960's, writing scripts for "Studio One", "Kraft Theatre", "U.S. Steel Hour", "Playhouse 90", "Suspense", "Danger", and other network dramatic shows. He received "Emmy" awards from the National Academy of Television Arts and Sciences for his television plays in 1955, 1956, 1957, 1959–61, and 1963–64. Among

his most highly praised television dramas, some of which have been controversial in theme, were *The Rack* (1955) and *Requiem for a Heavyweight* (1956). From 1959 until 1964 Serling was writer-producer of "The Twilight Zone", a television series featuring bizarre tales akin to science fiction. In 1970 he produced "Night Gallery", another television series. Serling also wrote screenplays for many theatrical films, including *The Man* (1972).

SERMON ON THE MOUNT. See BEATITUDES; JESUS CHRIST; MATTHEW, GOSPEL ACCORDING TO SAINT.

SEROWE, town in Botswana, and capital of Ngwato District, 38 miles N.W. of Palapye, its rail station, and about 200 miles S.W. of Bulawayo, Rhodesia. A trade center and the largest town of Botswana, it is the headquarters of the Bamangwato tribal reserve. A monument (1925) honors the tribal leader Khama (1835–1923), who moved his capital to Serowe from Palapye. Pop. (1971) 15,723.

SERPENTINE, common, widely distributed mineral, composed of hydrated magnesium silicate, $Mg_3Si_2O_5(OH)_4$, so called because of serpentlike green bands of color occurring in massive varieties. It crystallizes (see CRYSTAL) in the monoclinic system and occurs in two distinct forms: antigorite, a massive variety, and chrysotile, a fibrous variety. The massive variety has a greasy, waxy luster and the fibrous variety is silky. Both varieties are colored light and dark green, which in massive formations of antigorite produce a beautiful, variegated coloring. The term serpentine is also applied to a rock composed principally of antigorite. The hardness (q.v.) of the mineral ranges from 2 to 5, and the specific gravity ranges from 2.2 for chrysotile to 2.65 for antigorite. Chrysotile is the mineral from which asbestos (q.v.) is made. Antigorite, often used as an ornamental stone, sometimes occurs as a collateral mineral in verd antique marble. Serpentine always occurs as an alteration product of another magnesium silicate mineral, such as olivine (q.v.), amphibole, or pyroxene (see PYROXENES). Large deposits of chrysotile are located in Canada, in the U.S.S.R., in South Africa, and in Vermont, New York, New Jersey, and Arizona in the United States.

SERRA, Junípero, original name MIGUEL JOSÉ SERRA (1713–84), Spanish Franciscan missionary to North America, born on the island of Mallorca. He joined the Franciscans (q.v.) in 1730 and one year later began teaching philosophy under his Franciscan name of Junípero. In 1749 he was sent as a missionary to Mexico, where he worked among the Indians of the Sierra Gorda

SERTORIUS

region and taught at San Fernando College, Mexico City. In 1767 he was appointed superior of the California missions, and in 1769, on an expedition to Upper California, he founded San Diego, the first mission in the present-day State. Over a period of years Father Junípero founded many missions that later became settlements and cities in California, including San Carlos Borromeo (Carmel, 1770), San Gabriel (1771), San Luis Obispo (1772), San Francisco (1776), Santa Clara and San José (1777), Los Angeles (1781), and San Buenaventura (Ventura, 1782). See also CALIFORNIA: History; MISSIONARY MOVEMENTS.

SERTORIUS, Quintus (about 121–72 B.C.), Roman general and statesman, born in Nursia in the Sabine territory. In 102 B.C. he served at Aquae Sextiae (now Aix-en-Provence, France) under the Roman general and statesman Gaius Marius (q.v.) in the war against the Teutones (q.v.). Sertorius served in Spain in 98 B.C., and in 91 B.C. he became quaestor of Cisalpine Gaul. On the outbreak in 88 B.C. of the struggle between the party of nobles under the Roman general and statesman Lucius Cornelius Sulla (q.v.) and the popular party headed by Marius, Sertorius joined Marius. He fought, in conjunction with the Roman patrician Lucius Cornelius Cinna (q.v.), the Battle at the Colline Gate, which placed Rome at the mercy of the Marians, but he took no active part in the bloody massacres that followed. He became praetor in 83 B.C. With the triumphal return of Sulla from the East later in 83 B.C., Sertorius went to Spain, where he continued the struggle against Sulla and the aristocratic faction of Roman society. In 80 B.C. he accepted an invitation to head a native uprising in Lusitania (q.v.), which is now mostly Portugal, and proceeded to establish many reforms. He built up a stable government, founded a Roman school for the Spanish children, and trained the native forces on the model of a Roman army. As the head of a growing anti-Sullan power in Spain, he was joined by Marian troops from Italy and successfully defied the power of Rome, defeating the Roman generals who were sent against him, including Pompey the Great (q.v.). Sertorius was virtually a monarch in Spain, but his power was undermined by jealousies among his supporters. He was assassinated by a conspiracy of Roman officers led by the Roman soldier Marcus Perperna (fl. 1st century B.C.), who was in turn defeated by Pompey and put to death. This defeat marked the complete collapse of the Marian forces in Spain.

SERUM SICKNESS. See ALLERGY.

SERVAL, long-legged wildcat, *Felis serval*, of the Cat family, Felidae, native to grasslands and

brush country of subSaharan Africa. Buff-colored with black spots in rows down its back and legs, the serval has a slender body up to 4 ft. long and 20 in. high at the shoulder, and a small head with long, triangular ears; it weighs about 35 lb. It feeds mostly on small mammals, lizards, and birds, although it is powerful enough to kill young antelope; it hunts by speed rather than stealth and climbs trees well. When captured young, servals can be tamed, but they are difficult to raise.

SERVETUS, Michael (Sp. *Miguel Serveto*) (1511–53), Spanish physician and theologian, born in Tudela, Navarra Province. He studied law at the University of Toulouse, medicine at the universities of Paris and Montpellier, and theology at Louvain. Beginning in 1540 he practiced medicine in Vienne, France, where he also served as the personal physician to the archbishop. About 1545 he began a correspondence with the French Protestant theologian John Calvin (q.v.). Although still a nominal Catholic, he described his heretical opposition to the concept of the Trinity (q.v.) and requested permission to visit the theocratic city of Geneva, Switzerland. As a result of his unorthodox religious ideas, he was arrested while attending church in Geneva, convicted of heresy and blasphemy against Christianity, and burned at the stake on Oct. 27, 1553.

Servetus' religious opinions were strongly opposed by Catholics and Protestants of his time. In 1531 he repudiated, in his *De Trinitatis Erroribus* ("On the Error of the Trinity"), the tripartite personality of God as well as the ritual of Baptism (q.v.). In 1532 he wrote *Dialogorum de Trinitate Libri Duo* ("Second Book of Dialogues on the Trinity"). His scientific contributions were also notable; his *Christianismi Restitutio* ("The Restoration of Christianity"), published shortly before his death in 1553, included the first accurate description of the pulmonary circulatory system in the history of medicine.

SERVICE, Robert William (1874–1958), Canadian poet, born in Preston, England, and educated at the University of Glasgow. He emigrated to Canada in 1894, was a farmer on Vancouver Island, and then was employed by a bank in Victoria, British Columbia. The bank transferred him in 1906 to various branches in the Yukon region of Canada, and for a number of years he worked and traveled widely throughout the area. Subsequently he was a war correspondent for the *Toronto Star*, reporting the second of the Balkan Wars and World War I (qq.v.); in the latter conflict, he also served as an ambulance driver in the Canadian army.

Service is known primarily for his poems, influenced by the British writer Rudyard Kipling (q.v.), describing the elemental and adventurous life of gold prospectors and other inhabitants of the subarctic regions of northwestern North America. His best-known poem, "The Shooting of Dan McGrew", appeared in the volume of poetry *Songs of a Sourdough* (1907), which was later republished as *The Spell of the Yukon and Other Verses*. He also wrote the volumes of poetry *Ballads of a Cheechako* (1909), *Rhymes of a Rolling Stone* (1912), *Rhymes of a Red Cross Man* (1916), and *Ballads of a Bohemian* (1920); the novels *The Trail of '98* (1910), *The Roughneck* (1923), and *The House of Fear* (1927); and the autobiographies *Ploughman of the Moon* (1945) and *Harper of Heaven* (1948). **SERVICEBERRY.** See SHADBUSH.

SERVITES, in full ORDER OF THE SERVANTS OF MARY, originally order of "Religious Servants of the Holy Virgin". The order was founded in 1233 by seven Florentine merchants, who retired outside Florence in an area known as Cafaggio. Desirous of more seclusion, some of them went, in 1241, to Monte Senario, 12 mi. from the city. The groups were reunited in 1244. They adopted the Rule of Saint Augustine (see AGUSTINIANS; ORDER, RELIGIOUS) with some adaptations and were approved by Pope Alexander IV (r. 1254–61) in 1256. The general headquarters are still in Monte Senario. The order was introduced into Great Britain in 1864 and into the United States in 1870. They devote themselves to mission and educational work in the U.S., where, according to the latest available statistics, membership totaled more than 300 priests and brothers.

SERVOMECHANISM, in engineering, a device or combination of devices for automatic control of a mechanism or a source of power or energy (qq.v.); see AUTOMATION; MECHANICS. The defining characteristic of a servomechanism is that the controlled output of a mechanism is automatically compared with the controlling input. The difference between the settings or positions of the output and the input is called the error signal, and this signal acts to bring the output to its desired value. Servomechanisms may be mechanical, electrical, hydraulic, or optical. The process of sending the error signal back for comparison with the input is called feedback, and the whole process of the input, output, error signal, and feedback is called a closed loop.

The power steering system in an automobile (q.v.) is an example of a servomechanism. The direction of the front wheels is controlled by

the angle of the steering wheel. Should the motion of the car turn the front wheels away from the desired direction, the servomechanism, consisting of a mechanical and hydraulic system, automatically brings the wheels back to the desired direction. Another example of a servomechanism is the automatic control system by which a thermostat (q.v.) in one of the living rooms of a house controls the heat output of the heating furnace. Other examples include automatic pilots used on ships, aircraft, and space vehicles, in which the direction of motion of the vehicle is controlled by a compass setting; see COMPASS: Gyrocompass. Unmanned spacecraft are automatically turned to point their cameras, radio antennae and solar panels in the desired directions by servomechanisms. The input in that case is the sensing of the direction of the sun and stars, and the output is the control of small jets that turn and orient the spacecraft.

See also CYBERNETICS.

SESAME, annual herbaceous plant of the genus *Sesamum*, cultivated throughout the East from the Arab Republic of Egypt to Japan for the seeds, which yield an oil. This oil is used in cookery, for lighting, and for lubrication. It is odorless, has a sweet taste, and keeps for years without becoming rancid. Sesame is sometimes called tilseed.

SESQUICENTENNIAL EXPOSITION. See EXHIBITIONS AND EXPOSITIONS: *Famous 20th-Century Expositions*.

SESSHU (1420?–1506), Japanese painter and Buddhist priest of the Zen sect, trained in art by the Sino-Japanese painter Shubun (fl. first half of 15th cent.). In 1467 Sesshu visited China, living at the imperial court in Peking. The duration of his stay in China is not known, but he was little influenced by the art styles of the contemporary Ming dynasty (1368–1644), modeling his work instead on the landscape painting of the Sung dynasty (960–1279). Some of his paintings are executed in a precise, vigorous style achieved through the use of a brush loaded with almost dry pigment, applied to the painting in meticulously planned strokes. Others are freely and impressionistically executed in a technique utilizing liquid pigment, often deposited in splashes. Sesshu is generally considered one of the greatest of Japanese painters. His most celebrated work is a landscape scroll painting in the Prince Mori Motoaki Collection in Tokyo. See JAPANESE ART AND ARCHITECTURE: *Painting and Sculpture*.

SESSIONS, Roger Huntington (1896–), American composer and teacher, born in New

York City, and educated at Harvard University. He held several academic posts and worked in Europe on various fellowships until 1935, when he became assistant professor of music at Princeton University. From 1945 to 1952 he was professor of music at the University of California, and from 1953 to 1965, professor of music at Princeton. A member of the American Academy of Arts and Letters, he received the gold medal of the National Institute of Arts and Letters in 1961. In 1974 he was awarded a special Pulitzer Prize in recognition of his oeuvre.

His compositions, which are complex, distinctive, and atonal, that is, generally unrelated to traditional musical keys, include the operas *The Trial of Lucullus* (1947) and *Montezuma* (1959–63), as well as six symphonies, three piano sonatas, two string quartets, violin and piano concertos, and *Divertimento for Orchestra* (1959–60). In 1970 he published a series of lectures as *Questions about Music*. See AMERICAN MUSIC: *Musical Independence*.

SET or **SETH**, Egyptian god. See EGYPTIAN RELIGION: *Origins in Myth and Nature*; OSIRIS.

SETH, in the Old Testament, third son of Adam and Eve (q.v.).

SETI, name of two Egyptian kings of the XIX Dynasty.

Seti I (r. 1313–1292 B.C.), second king of the XIX Dynasty, the son and successor of King Ramses I (see under RAMSES). From 1314 B.C. he ruled as coregent with his father for a short time. He made an effort to recover some of the Syrian possessions Egypt had lost during the internal dissensions that marked the close of the XVIII Dynasty. Later in his reign Seti conquered Palestine, defended his western frontier against the Libyans, and fought against the Hittites (q.v.). Seti's magnificent tomb in the Valley of the Kings, near Thebes, and his temple at Abydos are impressive architectural monuments. The mummy of the king was found in 1881 at Deir el Bahri.

Seti II (r. 1209?–1205 B.C.), son of Merneptah (r. about 1225–1215 B.C.) and last king of the XIX Dynasty.

SÉTIF, city in Algeria, and capital of Sétif Department, in the Tell region, 70 miles s.w. of Constantine. Lying to the s. of the Babor Range in the Little Kabylia region of the High Plateaus, it is a road and market center on a railroad. The surrounding area produces grain and livestock; formerly extensive phosphate deposits are now declining. Industries in the city include flour milling and woodworking and the manufacture of carpets and metal handicrafts. Zinc deposits are nearby, and a hydroelectric development is

to the n. Founded as the Roman veterans' colony of Sitifis in the 1st century A.D., the community became a leading city of Mauretania Province in the 3rd century. The French occupied Sétif in the 19th century, and a fortified post was established in 1838. Pop. (1967) 98,000.

SETON, Saint Elizabeth Ann (1774–1821), educator and philanthropist. With her canonization in 1975 she became the first American-born saint of the Roman Catholic Church. Born Elizabeth Ann Bayley in New York City, Aug. 28, 1774, she was married in 1794 to William Seton (d. 1803), a successful merchant, and they had five children. She accompanied him to Italy in 1803, following a reversal in their fortunes; some months after his death in Pisa she returned to New York City and, in 1805, became a Roman Catholic. In 1809 she established in Emmitsburg, Md., the first house of what afterward grew into a widespread religious community known as the Sisters of Charity, with a rule, or constitution, modeled upon that of the Daughters of Charity of the French priest Saint Vincent de Paul (q.v.). She was elected the first superior of the order and held that office until her death. Parochial education in the U.S. began with her establishment of a Catholic school in Emmitsburg, and she was noted throughout her life for her ministrations to the poor and sick.

SETON, Ernest Thompson, originally ERNEST SETON THOMPSON (1860–1946), American writer and illustrator, born in South Shields, Durham, England. As a child he lived in remote parts of Canada, and from 1882 until 1887 he lived on the western plains of Canada and the United States. He studied art at the Royal Academy, London, and from 1890 to 1896, under various masters at Paris. Writing and drawing at first under his original name and later as Ernest Thompson Seton, he became noted for his books of nature stories, which he illustrated. In 1902 he founded in the U.S. the Woodcraft Indians, an organization of boys for the study of woodcraft and of nature. Some of the principles of the Woodcraft Indians were later adopted by the British army officer Sir Robert Stephenson Smyth Baden-Powell (q.v.) for the organization known as the Boy Scouts (q.v.). The Boy Scouts, founded in 1908 in England, was established in 1910 in the U.S. As the chief scout of the American organization, Seton was a leader of the Boy Scout movement in America from its inception until 1915, when he resigned and founded the Woodcraft League of America, similar to his original Woodcraft Indians. Among his writings are *Wild Animals I Have Known* (1898) and *Biography of an Arctic Fox* (1937).

SETON HALL UNIVERSITY, coeducational institution of higher learning, located in South Orange, N.J., with divisions in Paterson and Newark, and operated under the auspices of the Roman Catholic archdiocese of Newark, N.J. The university was founded in 1856, chartered as Seton Hall College in 1861, and officially designated a university in 1950. Instruction is offered in the arts and sciences, business administration, law, nursing, and teacher education. The university confers the B.A., B.S., J.D., M.A., M.S., D.D.S., and Ph.D. degrees. In 1968 the library contained more than 200,000 bound volumes. In 1968 enrollment at Seton Hall University totaled 9753 students, and the faculty numbered 543 members. The endowment of the institution was about \$3,863,000.

SETS, THEORY OF, branch of mathematics, first given formal treatment by the German mathematician Georg Cantor (q.v.). The set concept is one of the most basic in mathematics, even more primitive than the process of counting, and is found, explicitly or implicitly, in every area of pure and applied mathematics. Explicitly, the principles and terminology of sets are used to make mathematical statements more clear and precise and to clarify concepts such as the finite and the infinite.

A set is an aggregate, class, or collection of objects, which are called the elements of the set. In symbols, $a \in S$ means that the element a belongs to or is contained in the set S , or that the set S contains the element a . A set S is defined if, given any object a , one and only one of these statements holds: $a \in S$ or $a \notin S$ (that is, a is not contained in S). A set is frequently designated by the symbol $S = \{ \quad \}$, with the braces including the elements of S either by writing all of them in explicitly or by giving a formula, rule, or statement that describes all of them. Thus, $S_1 = \{2, 4\}$; $S_2 = \{2, 4, 6, \dots, 2n, \dots\} = \{\text{all positive even integers}\}$; $S_3 = \{x|x^2 - 6x + 11 \geq 3\}$; $S_4 = \{\text{all living males named John}\}$. In S_3 and S_4 it is implied that x is a number; S_3 is read as the set of all x 's such that $x^2 - 6x + 11 \geq 3$.

If every element of a set R also belongs to a set S , R is a subset of S , and S is a superset of R ; in symbols, $R \subseteq S$, or $S \supseteq R$. A set is both a subset and a superset of itself. If $R \subseteq S$, but at least one element in S is not in R , R is called a proper subset of S , and S is a proper superset of R ; in symbols, $R \subset S$, $S \supset R$. If $R \subseteq S$ and $S \subseteq R$, that is, if every element of one set is an element of the other, then R and S are the same, written $R = S$. Thus, in the examples cited above, $S_1 = S_3$, and S_1 is a proper subset of S_2 .

If A and B are two subsets of a set S , the elements found in A or in B or in both form a subset of S called the union of A and B , written $A \cup B$. The elements common to A and B form a subset of S called the intersection of A and B , written $A \cap B$. If A and B have no elements in common, the intersection is empty; it is convenient, however, to think of the intersection as a set, designated by \emptyset and called the empty or null set. Thus, if $A = \{2, 4, 6\}$, $B = \{4, 6, 8, 10\}$, and $C = \{10, 14, 16, 26\}$, then $A \cup B = \{2, 4, 6, 8, 10\}$, $A \cup C = \{2, 4, 6, 10, 14, 16, 26\}$, $A \cap B = \{4, 6\}$, $A \cap C = \emptyset$. The set of elements that are in A but not in B is called the difference between A and B , written $A - B$ (sometimes $A \setminus B$); thus, in the illustration above, $A - B = \{2\}$, $B - A = \{8, 10\}$. If A is a subset of a set I , the set of elements in I that are not in A , that is, $I - A$, is called the complement of A (with respect to I), written $I - A = A'$ (also written \bar{A} , $\sim A$).

The following statements are basic consequences of the above definitions, with A, B, C, \dots representing subsets of a set I .

1. $A \cup B = B \cup A$.
2. $A \cap B = B \cap A$.
3. $(A \cup B) \cup C = A \cup (B \cup C)$.
4. $(A \cap B) \cap C = A \cap (B \cap C)$.
5. $A \cup \emptyset = A$.
6. $A \cap \emptyset = \emptyset$.
7. $A \cup I = I$.
8. $A \cap I = A$.
9. $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$.
10. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.
11. $A \cup A' = I$.
12. $A \cap A' = \emptyset$.
13. $(A \cup B)' = A' \cap B'$.
14. $(A \cap B)' = A' \cup B'$.
15. $A \cup A = A \cap A = A$.
16. $(A')' = A$.
17. $A - B = A \cap B'$.
18. $(A - B) - C = A - (B \cup C)$.
19. If $A \cap B = \emptyset$, then $(A \cup B) - B = A$.
20. $A - (B \cup C) = (A - B) \cap (A - C)$.

If S is a set, the set of all subsets of S is a new set D , sometimes called the derived set of S . Thus, if $S = \{a, b, c\}$; $D = \{ \{ \}, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}, \{a, b, c\} \}$. Here, $\{ \}$ is used in place of the null set \emptyset , of S ; it is an element of D . If S has n elements, the derived set D has 2^n elements. Larger and larger sets are obtained by taking the derived set D_2 of D , the derived set D_3 of D_2 , and so on.

If A and B are two sets, the set of all possible ordered pairs of the form (a, b) , with a in A and b in B , is called the Cartesian product of A and B , frequently written $A \times B$. For example, if $A = \{1, 2\}$, $B = \{x, y, z\}$, then $A \times B = \{(1, x), (1, y), (1, z), (2, x), (2, y), (2, z)\}$. $B \times A = \{(x, 1),$

SETTER

$(y, 1), (z, 1), (x, 2), (y, 2), (z, 2) \}$. Here, $B \times A \neq A \times B$, because the pair $(1, x)$ must be distinguished from the pair $(x, 1)$.

The elements of the set $A = \{1, 2, 3\}$ can be matched or paired with the elements of the set $B = \{x, y, z\}$ in several (actually, six) ways such that each element of B is matched with an element of A , each element of A is matched with an element of B , and different elements of one set are matched with different elements of the other. For example, the elements may be matched $(1, y), (2, z), (3, x)$. A matching of this type is called a one-to-one (1-1) correspondence between the elements of A and B . The elements of the set $A = \{1, 2, 3\}$ cannot be put into a 1-1 correspondence with the elements of any one of its proper subsets and is therefore called a finite set or a set with finite cardinality. The elements of the set $B = \{1, 2, 3, \dots\}$ can be put into a 1-1 correspondence with the elements of its proper subset $C = \{3, 4, 5, \dots\}$ by matching, for example, n of B with $n + 2$ of C , $n = 1, 2, 3, \dots$. A set with this property is called an infinite set or a set of infinite cardinality. Two sets having elements that can be placed in a 1-1 correspondence are said to have the same cardinality. J.Si.

SETTER, variety of hunting dog formerly trained to crouch or set, on discovering game, with his nose pointing toward the place of concealment of the quarry, but now trained to stand rigid in the manner of the hunting dog known as the pointer. The principal breeds of setter are the English setter, Gordon setter, and Irish setter (qq.v.).

SETTIGNANO, Desiderio Da. See **DESIDERIO DA SETTIGNANO**.

SETTLEMENT, ACT OF, provision of an English statute enacted by Parliament in 1701. It secured the succession of the crown of England to members of the House of Hannover in the Protestant faith, unless either of the English queens, Mary II or Anne (qq.v.), provided an heir. The act had the effect of excluding Roman Catholics from the throne. King George I (q.v.) obtained the British throne in 1714 through the terms in the Act of Settlement. See also **ENGLAND: History: The Glorious Revolution**.

SETÚBAL, formerly called in English SAINT UBES, and in French SAINT YVES, city in Portugal, and capital of Setúbal District, Estremadura Province, on Setúbal Bay, about 20 miles S.E. of Lisbon. Setúbal is an important seaport. The city is a major sardine-canning center. Wine, fruit, and cork are exported. The Church of Santa Maria, built in the 16th century, is well known for its highly ornate interior. Pop. (1970) 58,581. **SEURAT, Georges** (1859-91), French painter, born in Paris, and trained at the École des Beaux-Arts. Seurat and his friend the French painter Paul Signac (1863-1935) originated the influential theory and practice of neoimpressionism. Their school of painting was based on a strict scientific application of the methods of impressionism (q.v.) and was characterized by the employment of a technique known as pointillism. In pointillism, forms are built up through the application of many small dots of unmixed color to a white background. Seurat's revolutionary pointillism found many pupils and imitators but, except in the work of Signac, was unequalled in its perfect blending of colors. Many of Seurat's theories in regard to painting were derived from his study of contemporary



"A Sunday Afternoon on the Island of La Grande Jatte" by Georges Seurat.

Art Institute of Chicago -
Helen Birch Bartlett
Memorial Collection

treatises on optics. His scientific bent was revealed also in his habits of painting, which included fixed working hours and the meticulous systematization of his technique.

In 1884 Seurat completed "Baignade" ("Bathers", Tate Gallery, London), a scene of boys bathing in the Seine R. and the first of six large canvases constituting the major part of his life's work. In this and subsequent works, he continued the impressionist tradition of depicting holiday outings and entertainments. He departed from impressionist style, however, in the precise application of the paint and in the suggestion of depth and volume. His masterpiece, "Un Dimanche d'Été à la Grande-Jatte" ("A Sunday Afternoon on the Island of la Grande-Jatte", 1884-86, The Art Institute, Chicago), represents Sunday strollers on an island in the Seine R. The painting achieves an atmosphere of monumental dignity through the balanced arrangement of its elements and the statuesque contours of its figures. Seurat's other large-scale works are "Les Poseuses" ("The Models", 1888, Barnes Collection, Philadelphia), "La Parade" ("The Side Show", 1889, Stephen Clark Collection, New York City), "Le Chahut" (1889, Ryks Museum, Amsterdam, the Netherlands), and "Le Cirque" ("The Circus", 1890, Louvre, Paris).

SEVAREID, Eric (Arnold) (1912-), American television commentator, news analyst, journalist, and author, born in Velva, N. Dak. He attended the University of Minnesota, graduating with a B.A. in political science in 1935. In 1936 he became a reporter on the *Minneapolis Journal*, but the following year he traveled to Europe and resumed his studies. He returned to newspaper work again in 1938 as a correspondent for the Paris edition of the *New York Herald Tribune*; a year later, he became its city editor. He also worked during this time as a night editor for the *United Press*. In August, 1939, Sevareid was hired by the American news commentator Edward R. Murrow (q.v.) as a radio commentator for the Columbia Broadcasting System (C.B.S.).

During World War II, he was assigned by C.B.S. to the European front (1939-40, 1944-45), the news bureau in Washington, D.C. (1941-43), and the China-Burma-India theater of operations (1943). His greatest journalistic achievement occurred early in the war, when he was the first to broadcast the news of the impending surrender of France to Germany. Subsequently, he has held a variety of assignments for C.B.S. radio and television. The recipient of many awards over the years for his reporting,

Sevareid is probably best known for his incisive news analyses and spirited commentaries delivered as national correspondent of C.B.S. News in Washington and during special elections coverage. He is the author of five books, including *Not So Wild A Dream* (1946), a best-selling autobiography, and *This is Eric Sevareid* (1964), a collection of his syndicated columns.

SEVASTOPOL', or SEBASTOPOL, city and port of the Soviet Union, in the Ukrainian S.S.R., in the Crimean Oblast, on the Black Sea, about 200 miles s.w. of Odessa. It is a major seaport and a principal naval base of the Black Sea. The city is on an inlet about 4 mi. long and nearly 1 mi. wide.

Among its industries are the production of machinery and flour milling. It is the site also of the biological station of the Leningrad Academy of Sciences. Noted structures in the city include the Cathedral of Saint Peter and Saint Paul, distinguished by its classical architecture, and the Cathedral of Saint Vladimir, built in 1888. Sevastopol' dates back to the 5th century B.C.; it was successively a Greek colony, a Byzantine city, and a settlement of the Tatars (q.v.). When the Crimea Peninsula was conquered by Russia in 1783, Catherine II, Empress of Russia (see under CATHERINE), founded the present city. In 1804 it became the chief Russian naval station on the Black Sea and was strongly fortified. The city sustained a siege of eleven months during the Crimean War (q.v.) and was practically demolished. After 1870, it was reconstructed and redesignated a Russian naval base. Pop. (1970) 229,000.

SEVEN AGAINST THEBES, in Greek mythology, ill-fated expedition against the city of Thebes, undertaken by seven chieftains and their followers under the leadership of Adrastus, King of Argos, and Polyneices, the son of Oedipus (q.v.), the former king of Thebes. After losing the throne to his younger brother Eteocles, Polyneices fled to Argos and married the daughter of Adrastus. The Argive king then organized a great army to march against the Thebans and restore Polyneices to the throne. The other leaders of the expedition were Tydeus of Calydon, Parthenopaeus of Arcadia, Capaneus and Hippomedon of Argos, and Amphiarus, the brother-in-law of Adrastus.

The seven gates of Thebes were defended by seven Theban champions. During the siege Polyneices and Eteocles slew each other, thus fulfilling the curse of their father. The battle ended with the defeat and death of all the Argives except Adrastus, who fled with his broken army to Athens. Ten years after the disaster, the sons of

SEVEN CHURCHES OF ASIA

the seven warriors, the Epigoni (q.v.), successfully marched against the city to avenge the deaths of the heroes.

SEVEN CHURCHES OF ASIA, churches addressed in the opening chapters of the New Testament book of Revelation (q.v.), under the following names, those of cities in what is now Turkey: Ephesus (q.v.), Smyrna (now İzmir, q.v.), Pergamum (q.v., now Bergama), Thyatira (now Akhisar), Sardis (q.v.), Philadelphia (q.v., now Alaşehir), and Laodicea (now Denizli). These churches represented the groups of churches of the Roman province of Asia. Listed together in Rev. 1:11, they are each addressed separately thereafter.

SEVEN DAYS' BATTLE, series of engagements during the American Civil War, occurring near Richmond, Va., between June 26 and July 2, 1862. These skirmishes were fought by Federal forces under the command of General George Brinton McClellan (q.v.) and Confederate forces under the command of General Robert Edward Lee (see under LEE). Lee prevented Union troops from capturing the Confederate capital at Richmond. See CIVIL WAR, THE AMERICAN; PENINSULAR CAMPAIGN.

SEVEN LIBERAL ARTS, in education, subjects of the ancient and medieval curriculum: grammar, logic, rhetoric, geometry, arithmetic, astronomy, and music (qq.v.). The distinction between the liberal arts and the practical arts originated in Greece. According to the Greek philosophers Plato and Aristotle (qq.v.), the liberal arts were those subjects suitable for the development of intellectual and moral excellence, as distinguished from those that were merely useful or practical. The Greeks assigned no definite number to such liberal arts, however. The first encyclopedic discussion of the seven liberal arts was that written in the 1st century B.C. by the Roman scholar Marcus Terentius Varro (q.v.); he also wrote books on the more utilitarian arts of medicine and architecture (qq.v.). The seven arts, as studied during the Middle Ages (q.v.), were known chiefly through writings of the 5th to the 7th century A.D., notably, the works of the Latin writer Martianus Capella (fl. 5th cent.), the Roman historian Flavius Magnus Aurelius Cassiodorus, and the Spanish scholar Saint Isidore of Seville (qq.v.). The medieval course of study was divided into the elementary trivium and the more advanced quadrivium. The trivium was comprised of grammar, which included the study of literature, dialectic (qq.v.) or logic, and rhetoric, which also covered the study of law. Completion of the trivium entitled the student to a bachelor's degree. The quadrivium

was comprised of arithmetic; geometry, which included geography and natural history; astronomy, to which astrology was often added; and music, chiefly that of the Church. Once the student completed the quadrivium, he was a master of arts; see DEGREE, ACADEMIC.

The term liberal arts is now often used for the unspecialized, nonscientific studies pursued in an undergraduate college; see EDUCATION; EDUCATION, HIGHER.

SEVEN PINES. See PENINSULAR CAMPAIGN.

SEVEN SEAS, ancient mariner's expression referring to all the oceans of the world, specifically the North and South Atlantic, the North and South Pacific, the Indian, the Arctic, and the Antarctic oceans. See OCEAN AND OCEANOGRAPHY.

SEVENTH-DAY ADVENTIST CHURCH, evangelical Protestant denomination (see ADVENTISM), with world headquarters in Washington, D.C. For administrative purposes, its world work is carried out by a general conference organized into twelve geographic divisions. Each of the divisions is composed of several union conferences, which in turn are made up of smaller local conferences. Governed by a representative system, each level, beginning with the local congregation, sends delegates to business sessions that convene at regular intervals, varying from two to five years.

Programs. The denomination conducts missionary, educational, and philanthropic programs, which are supported by a voluntary system of tithing (contributing a tenth of one's income) and freewill offerings. Church activities are maintained in all parts of the world, and denominational publications are printed in 197 languages and dialects. Notable among English-language periodicals are the general church paper *The Advent Review and Sabbath Herald*, founded in 1850; *The Signs of the Times*, founded in 1874; *These Times*, founded as the *Southern Agent* in 1891; and *Liberty* magazine, founded in 1906.

Throughout the world the church conducts the largest school system of any Protestant denomination. In the United States it maintains more than 1000 elementary and junior high schools, 94 high schools, 9 liberal arts colleges, and 2 universities that include graduate schools of theology, dentistry, medicine, other health professions, education, and arts and sciences.

Tenets. Two tenets of faith are prominent in Seventh-day Adventist theology: belief in the visible, personal Second Coming of Christ (see SECOND ADVENT OF CHRIST) at an early but indefinite date and the observance of Saturday as the

Sabbath (q.v.). Members accept the Bible as their sole religious authority, placing special trust in the literal interpretation of prophetic passages. They hold that grace (q.v.) alone is sufficient for salvation, administer baptism (q.v.) by immersion, and practice foot washing in connection with observance of the Lord's Supper (q.v.).

Seventh-day Adventists expect the eventual destruction of the wicked and everlasting life for the just, including the living and the resurrected dead, at the Second Advent of Christ. In their social life approved recreation replaces entertainments such as dancing and theatergoing. The denomination has a comprehensive program for youth of all ages. It strongly favors the principle of religious liberty and the separation of church and state.

Holding that the body is the temple of the Holy Spirit, Seventh-day Adventists put great stress on health and maintain more than 360 hospitals and clinics around the world.

History. The Seventh-day Adventist Church is the largest of the Adventist bodies that developed from the worldwide Second Advent movement of the early 19th century. In the U.S. the most prominent leader of this movement was a Baptist preacher, William Miller (1782-1849). Miller and his followers, known initially as Millerites, proclaimed that the Second Coming of Christ would occur on Oct. 22, 1844. The movement was widely ridiculed after that day passed uneventfully. A small group of these Adventists discovered the error in Miller's interpretation of the prophecies and continued to proclaim their confidence in the early return of Christ to the earth. One company, in Washington, N.H., influenced by a Seventh-day Baptist, began to observe Saturday as the Scriptural Sabbath instead of Sunday. Soon other groups in New England and the Middle West recognized Saturday as the Sabbath. These churches established headquarters in Battle Creek, Mich., and officially adopted the name Seventh-day Adventist in 1860. The denomination was formally organized in 1863. Headquarters was moved to Washington in 1903.

By 1975 the Seventh-day Adventist Church in the U.S. reported more than 500,000 members and some 3500 congregations. World membership exceeded 2,500,000.

GENERAL CONFERENCE OF SEVENTH-DAY ADVENTISTS
SEVENTH-DAY BAPTISTS. See BAPTIST: *Seventh-Day Baptist General Conference.*

SEVEN WEEKS' WAR, also known as the AUSTRO-PRUSSIAN WAR, fought from June 14 to Aug. 23, 1866, between Prussia, which was allied

with Italy, and Austria, which was supported by Bavaria, Württemberg, Baden, Saxony, Hannover, and several minor German States.

Causes. The central cause of the war was the dispute between Prussia and Austria regarding the duchies of Schleswig and Holstein, which the two countries had jointly taken from Denmark in 1864; see SCHLESWIG-HOLSTEIN. By the Convention of Gastein in 1865, Austria received jurisdiction over Holstein and Prussia over Schleswig and the duchy of Lauenburg. Neither Austria nor Prussia was satisfied, however, with the settlement.

The immediate cause of the war was the resolve of Prince Otto von Bismarck (q.v.), Prussian foreign minister, to use the Schleswig-Holstein situation to further the unification of Germany under Prussian control. The dominant powers in Germany at the time were Prussia and Austria. Both were member States in the German confederation that had been formed at the Congress of Vienna in 1815. It was to force Austria out of the confederation and leave Prussia the only strong power in Germany that Bismarck provoked the war with Austria. He interfered in the Austrian administration of Holstein, and, when Austria protested to the Diet, or legislative body, of the confederation, Bismarck marched troops into Holstein.

Military Aspects. On June 14, Austria declared war on Prussia. Although the numbers of men in the opposing armies were equal, the military brilliance of the German strategist Count Helmuth von Moltke (see under MOLTKE), chief of the Prussian general staff, quickly placed the Prussian army at a definite advantage. The Austrian forces were under the command of General Ludwig August von Benedek (1804-81). The war lasted less than two months. The Prussians invaded Saxony and Bohemia in mid-June. Then, on July 3, the Prussians inflicted a crushing defeat upon the Austrians at Königgrätz, or Sadowa (now Hradec Králové, Czechoslovakia), in Austria. Despite a previous Austrian victory over Italian troops in Venetia on June 24, Austria was so decisively overwhelmed at Königgrätz that it was forced to sue for peace.

Settlement of the Issues. By the terms of the Treaty of Prague signed on Aug. 23, 1866, the existing German confederation was dissolved. Austria ceded Holstein to Prussia and Venetia to Italy, and paid Prussia a small indemnity. In 1867 Prussia organized the North German Confederation (q.v.). Austria was excluded from the new confederation, leaving Prussia as the dominant power in Germany. The North German Confederation led to the formation of the German Em-

SEVEN WISE MEN OF GREECE, THE

pire. The Seven Weeks' War also led to the establishment, in 1867, of the dual monarchy of Austria-Hungary (q.v.).

See also GERMANY: *History*.

SEVEN WISE MEN OF GREECE, THE, also known as **THE SEVEN SAGES**, Greek sages of the 7th and 6th centuries B.C., who were active in science, philosophy, and politics. Although their identities do not always agree, the seven sages usually appear as Bias of Priene (fl. 6th cent. B.C.), Chilon of Sparta (fl. 6th cent. B.C.), Cleobulus of Lindus (fl. 6th cent. B.C.), Periander of Corinth (d. 585 B.C.), Pittacus of Mitylene (650?–570? B.C.), Solon (q.v.) of Athens, and Thales (q.v.) of Miletus.

SEVEN WONDERS OF THE WORLD, list of sites or objects deemed remarkable either for their great beauty, their uniqueness of architecture, or their historic or economic importance. Although lists of wonders have been compiled in many different categories, for example, wonders of medicine, communication, or transportation, four major such listings exist; these, although variable somewhat in content, are considered universal. They include two early lists, one of ancient-world wonders and the other of sites popular in the Middle Ages; third, a list of spectacular natural features; and, finally, a list of outstanding modern structures.

Seven Wonders of the Ancient World. The original listing of wonders is attributed to the Greek epigrammatist, Antipater of Sidon (fl. 2nd century B.C.) and names the seven most remarkable structures of antiquity. The list includes the pyramids (q.v.) of Egypt, which are the oldest, dating from about 2690 B.C., and the best preserved of the wonders; the hanging gardens of Babylon (q.v.), constructed by King Nebuchadnezzar II (*see under* NEBUCHADNEZZAR) in the 6th century B.C.; the temple of the Greek goddess Artemis (q.v.) at Ephesus, erected during the 4th century B.C.; the statue of the Greek god Zeus (q.v.), made by the Greek sculptor Phidias (fl. 5th century B.C.) about 435 B.C. at Olympia; the mausoleum (q.v.) at Halicarnassus, a marble tomb about 135 ft. high, built for King Mausolus (fl. 4th century B.C.) of Caria, and of which only pieces remain; the Colossus of Rhodes, a statue of the Greek sun god Helios (q.v.), about 105 ft. high, erected near the harbor of Rhodes (q.v.) in the Aegean Sea around 280 B.C. and destroyed about sixty years later; and the Pharos, or lighthouse, at Alexandria, Egypt, about 200 ft. high with a guiding fire at its peak, completely destroyed during the 14th century.

Seven Wonders of the Middle Ages. The second listing names sites or structures considered

significant by the people of the Middle Ages (q.v.). It includes, the Colosseum, of Rome, an amphitheater (q.v.) once used for Roman spectacles and contests and now in ruins; the catacombs (q.v.) of Alexandria, Egypt, underground tunnels used for refuge by the early Christians; the Great Wall (q.v.) of China, started in the 3rd century B.C. as a protective barrier; Stonehenge (q.v.), on the Salisbury Plain in England, thought to have been a monument for worship during the Middle Ages but now known to have existed during prehistoric times, supposedly for astrological observation; the Leaning Tower of Pisa (q.v.), Italy, begun in 1174 A.D. and today slanting more than 14 ft. from the perpendicular; the Porcelain Tower of Nanking, in China, built to a height of 260 ft. during the 15th century and destroyed in 1853; and the Mosque of Saint Sophia (q.v.) at Constantinople (now Istanbul), originally a Christian church, but now a museum, built about 537 A.D.

Seven Natural Wonders of the World. The list of seven natural wonders names areas of geological significance and was compiled by world travelers during recent centuries. Usually included in this grouping are Mt. Everest (q.v.), in south-central Asia, the highest-known mountain in the world; Victoria Falls (q.v.), a 400-ft. waterfall of the Zambezi R. in southern Africa; the Grand Canyon (q.v.) in Arizona; the Great Barrier Reef (q.v.), a chain of coral reefs located off the east coast of Queensland, Australia; the Northern Lights (*see* AURORA), a luminous phenomenon occurring in countries of the extreme north; Parícutin, one of the world's youngest volcanoes (*see* VOLCANO), discovered in 1943 west of Mexico City; and the harbor at Rio de Janeiro, Brazil, as seen from the sea.

The Seven Modern Wonders of the World. Chosen by modern travelers and explorers, this list is composed of man-made structures significant in contemporary civilization. It includes the Suez Canal (q.v.), connecting the Mediterranean and Red seas; the Eiffel Tower (q.v.), in Paris; the Alaska Highway (q.v.), a scenic modern roadway connecting Alaska with Canada; the Golden Gate Bridge (q.v.), in San Francisco, Calif., one of the longest single-span suspension bridges in the world; the Empire State Building, in New York City, for many years the world's tallest skyscraper; Dneproges Dam, an extensive power station on the Dnieper R. in the Ukrainian S.S.R.; and the Panama Canal (q.v.), joining the Atlantic and Pacific oceans across the Isthmus of Panama.

SEVEN YEARS' WAR, worldwide series of conflicts fought from 1756 to 1763 to establish con-

trol of Germany and to determine colonial supremacy in North America and India. It involved most of the major powers of Europe, in particular Prussia, Great Britain, and Hannover on one side, and Austria, Saxony, France, Russia, Sweden, and Spain on the other. The North American segment of the conflict, known as the French and Indian War (q.v.), involved Great Britain and her American colonies against the French and their Algonquian (q.v.) allies. The Indian phase established British domination in India (q.v.).

European Phase. Austria's resolve to repossess the rich province of Silesia (q.v.), which had been lost to Prussia in 1748 (see **SUCCESSION WARS**), was the major conflict leading to the Seven Years' War. Maria Theresa (q.v.), Archduchess of Austria and Queen of Hungary and Bohemia, acquired the support of Russia, Sweden, Saxony, Spain, and France, with the specific aim of waging war against Prussia and her ally, Great Britain. Frederick II (q.v.), King of Prussia, initiated hostilities with his attack and capture of Saxony in 1756.

Through the first half of the war, the Prussians continued victorious. They defeated the French at Rossbach and the Austrians at Leuthen in 1757, thereby temporarily recovering Silesia, and the Russians at Zorndorf in 1758. At this point, however, with Sweden entering the war and virtually all Europe opposing Frederick, the tide seemed to turn. By 1759 eastern Prussia was in the hands of the Russians, and Berlin had been captured. The Prussian situation was desperate. Two significant factors, however, led to the eventual return of Prussian dominance in the war. One was the active support of the British and Hannoverians; both, until this point ineffective combatants, now fought successfully against the French. The second, and more important, was the withdrawal in 1762 of Russia and Sweden from the war. This occurred as a result of the death of Elizabeth Petrovna (q.v.), Empress of Russia; her successor, Peter III (see *under* **PETER**), an admirer of Frederick, signed a peace treaty with the Prussian leader.

American Conflict. In North America, the war began in 1754. Colonial rivalry had gradually developed between France and Great Britain over lucrative fur-trading posts and land west of the Appalachian Mts., and also over fishing rights off the coast of Newfoundland. The French, through a strategy of encirclement, hoped to contain English settlement, particularly in the Ohio valley, where Virginia planters established fur-trading posts in 1749. By resisting British expansion westward, France hoped to unite,

through a chain of forts, their Canadian empire with possessions as far south as New Orleans; see **LOUISIANA PURCHASE**.

During the first two years of the war, French and Indian forces were largely victorious, winning an important and surprising victory in defending Fort Duquesne. In 1757, however, the British statesman William Pitt (see *under* **PITT**), a pro-Prussian, was given complete charge of British foreign policy and appointed the British general James Wolfe (q.v.) to command the troops in the New World. Pitt's bold strategy ultimately resulted in defeat for the French. By 1760 the British had conquered all of French Canada.

Indian Theater. Britain was also victorious in India, completely demolishing French plans for control of the country. Responsible for much of the success was the British soldier Robert Clive (q.v.). Important events of the war include the Battle of Plassey and the atrocity alleged to have occurred in the Black Hole (q.v.), a prison cell in Calcutta.

Peace Terms. The Seven Years' War officially ended in 1763. On Feb. 10, the Treaty of Paris was signed to settle differences between France, Spain, and Great Britain. Among the terms was the acquisition of almost the entire French empire in North America by Great Britain. The British also acquired Florida from Spain, and the French retained their possessions in India only under severe military restrictions. The continent of Europe remained free from territorial changes.

On Feb. 15, the Treaty of Hubertusburg was signed at Hubertusburg, Saxony. This agreement confirmed Prussia's possession of Silesia, and established her as a leading power in Europe. **SEVERN**, Great Britain, river rising in the Plynlimmon Mts. in Montgomeryshire, Wales, and flowing e. through Shropshire, England, and s. through Worcestershire and Gloucestershire, until it forms a large estuary that widens into the Bristol Channel. The river is about 210 mi. long. It is a principal river of the island and is navigable for about 180 mi., from the Bristol Channel to Welshpool, Wales. The Avon and the Wye rivers are among the tributaries; the river is an excellent source of salmon with its tributaries abounding in trout. Canals connect the Severn with the Thames, Trent, and Mersey rivers. A tunnel under the estuary, about 4 mi. long, connects Bristol with s. Wales.

SEVERSKY, Alexander Procofieff de. See **DE SEVERSKY, ALEXANDER PROCOFIEFF**.

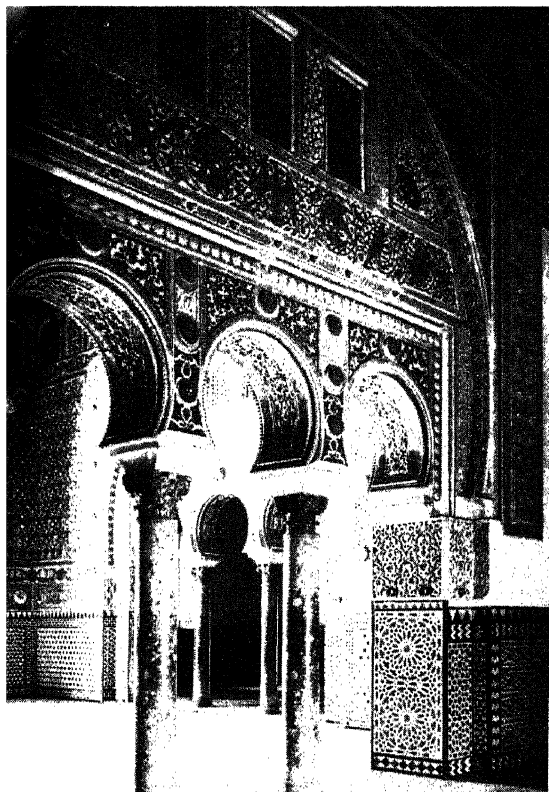
SEVERUS, Lucius Septimius (146–211), Roman Emperor (193–211), born in Leptis Magna (near

SEVERUS

the modern city of Homs, Libya). After receiving a law education in Rome, Severus held a number of military and political titles. He became *quaestor militaris* in the province of Baetica in Spain in 172, and by 190 he was governor of Pannonia, a Roman province in central Europe. When the Roman emperor Lucius Aelius Aurelius Commodus (q.v.) was murdered in 192, the Roman consul Publius Helvius Pertinax (126–193) became emperor. He, in turn, was slain a year later, and Severus determined to avenge his death, returned to Rome with his army. Severus became emperor after the murder of Didius Salvidius Julianus (133–193), who had succeeded Pertinax by purchasing the throne from the Praetorian Guard (q.v.). Severus punished the murderers of Pertinax and disbanded the praetorian troops, reorganizing the guard on entirely new principles. In 194, he defeated the Roman governor of Syria, Gaius Pescennius Niger (fl. 2nd cent.), a rival for the throne, and captured the ancient city of Byzantium (q.v.). He fought in Gaul (q.v.) with the Roman general Decimus Clodius Septimius Albinus (fl. 2nd cent.) who had been proclaimed emperor by his legions after the death of Pertinax and who was conquered by Severus in 197. After his brilliant suc-

The Alcazar at Seville, begun at the end of the 12th century, is a masterpiece of Moorish architecture.

Spanish Tourist Office



cess against the Parthians of Persia who had invaded Mesopotamia in Asia, Severus sailed to Britain to quell a revolt there in 208. He traveled with his army to the north of the island, encountering extreme hardships, and died at York. To safeguard Roman territory in southern Britain from northern invaders, he ordered the construction of a stone wall that can still be traced today; see ROMAN WALL. Severus's reign marks a period of both jurisdictional and military reform. Some of his changes include allowing veteran officers to hold civil service jobs; improving the soldiers' conditions, and creating a new imperial treasury.

SEVIER, John. See FRANKLIN, STATE OF; TENNESSEE: *History*.

SÉVIGNÉ, Marquise de (1626–96), French writer, born Marie de Rabutin-Chantal in Paris. At eighteen she married a French nobleman, Marquis Henri de Sévigné (d. 1651), who was killed in a duel. She enjoyed the friendship of many distinguished people and today is best known for her letters, numbering more than 1500 and chronicling in detail life among court and high society in 17th-century France.

SEVILLE or SEVILLA, city and port in Spain, and capital of Seville Province, on the left bank of the Guadalquivir R., about 55 mi. from the Atlantic Ocean. It is one of the most important river ports in Spain. Among its exports are iron ore, lead, wine, olives, cork, mercury, and oranges. Industries include the manufacture of iron, porcelain and earthenware, tobacco, fish canneries, distilleries, textiles, soap, and furniture. Landmarks in the city date back to the Middle Ages, for example, the Alcázar, a royal palace built by the Moors in 1181. Traces of early Moorish civilization are also evident in the small, winding streets, the low, white houses with balconies, the courtyards, and the fountains, as well as in the remains of a wall that once surrounded the city. A vast Gothic cathedral, started in 1402 and finished in 1519, stands on the site of a 12th-century Muslim mosque. The cathedral houses world-renowned paintings by such famous Spanish artists as El Greco, Bartolomé Esteban Murillo, and Francisco de Zurbarán (qq.v.). The Giralda, the cathedral's bell tower, standing more than 300 ft. high, originally served as the minaret, or calling tower, for the mosque. The University of Seville, established in 1502, is located in the city. The Archivo de Indias, a large collection of books, manuscripts, and documents on the history and administration of the Spanish empire in the Americas, has been stored at the Casa Lonja in the city since 1785.

History. Called *Hispalis* during ancient times, Seville was captured in 45 B.C. by the Roman general and statesman Gaius Julius Caesar (q.v.). During the next few centuries, Seville was under control of the Vandals (q.v.), the Visigoths (see *GOTHS*), and the Moors (q.v.) respectively. It flourished as a cultural center under Moorish domination, which lasted from 712 A.D. until 1248 A.D. It was then conquered by Ferdinand III (q.v.), King of Castile and León. The discovery of America in 1492 proved extremely profitable for the city as prolific trading developed rapidly between the two continents. By the 17th and 18th centuries, Seville became the leading center of Spanish culture. The remains of Christopher Columbus (q.v.), the discoverer of America (q.v.), were interred in the cathedral in 1898. The Spanish-American Exhibition of 1929, an expression of Ibero-American relations, was held in Seville. Pop. (1970 prelim.) 545,700.

SÈVRES, town of France, in Hauts-de-Seine Department, on the left bank of the Seine R., about 7 miles S.W. of Paris. Sèvres is famous for the production of a type of porcelain (q.v.) characterized by a fine, elaborate design and internationally known as Sèvres. Glassworks, distilleries, and breweries are also located in the town. Sèvres was the site of the signing of the Treaty of Sèvres following World War I; see *SÈVRES, TREATY OF*. Pop. (1968) 20,228.

SÈVRES, TREATY OF, peace treaty between Turkey and the Allied powers, excluding the Soviet Union and the United States, following World War I. The agreement was signed on Aug. 10, 1920, at Sèvres, France. It dissolved the Ottoman Empire (q.v.) and limited Turkey to the city of Constantinople (now Istanbul) and surrounding territory and to part of Asia Minor (q.v.). The treaty, acceptable to Mohammed VI, Sultan of Turkey (1861–1926), and the existing government, was not acknowledged by the Turkish statesman Kemal Atatürk (q.v.). As head of the Nationalist Party, Atatürk undertook the overthrow of the government. Together with his nationalistic forces, he set up the republic of Turkey with Angora (now Ankara) as its capital. His attacks against the French, Italian, and Greek armies, who had inhabited his country, were successful and led to agreements with the Allies. The Conference of Lausanne held in 1923 resulted in a general treaty more favorable to the Turkish cause. See *TURKEY: History*.

SÈVRES WARE. See *PORCELAIN*.

SEWAGE DISPOSAL, or **WASTEWATER DISPOSAL**, various processes involved in the collection, treatment, and sanitary disposition of liquid and water-carried wastes from households

and industrial plants. The issue of sewage disposal assumed increasing importance in the early 1970's as a result of the general concern expressed in the United States and worldwide about the wider problem of pollution of the human environment, the contamination of the atmosphere, rivers, lakes, seas, and oceans by domestic, municipal, agricultural, and industrial waste products. The magnitude of the sewage problem is indicated by the projected increase in the funds assigned in the U.S. to pollution-control plants from \$7,500,000,000 in the decade 1955–65 to more than \$15,000,000,000 during the decade 1965–75. Another \$25,000,000,000 were estimated to be necessary for the purpose of modernization of the combined system of sewers. See *AIR POLLUTION*; *WATER POLLUTION*.

NATURE OF SEWAGE

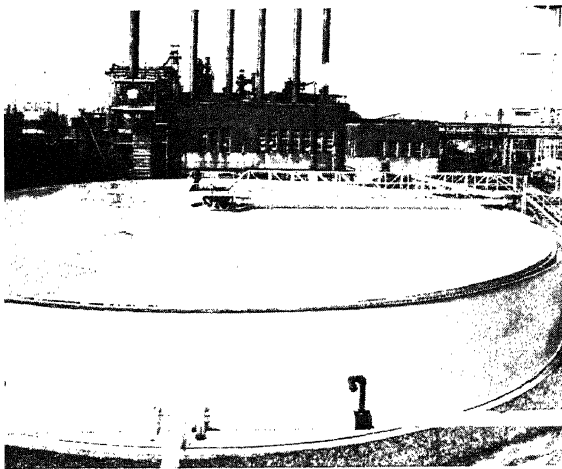
The origin, composition, and quantity of waste is related to existing life patterns. When waste matter enters water, the resulting product is called sewage or wastewater.

Origin and Quantity. Wastewater originates mainly from domestic, industrial, groundwater, and meteorological sources, and these forms of wastewater are commonly referred to as domestic sewage, industrial waste, infiltration, and storm water drainage respectively.

Domestic sewage results from the day to day activities of people such as bathing, body elimination, housekeeping, cooking, and recreation, averaging about 60 gal. per capita per day or more in congested metropolitan areas. The quantity and character of industrial wastewater is highly varied, depending upon the type of industry, the management of its water usage, and the degree of treatment before the wastewater is discharged. A slaughterhouse, for example, may produce 100 to 1500 gal. per animal processed, a paper company may produce 2000 to 4000 gal. per ton of finished product, and a steel mill 1500 to 40,000 gal. per ton of steel manufactured, depending on the two extremes of judicious and careless water management and recycle.

Infiltration depends more on the nature of the location and the condition of the sewer system than on the activities of man. It is undesirable because it imposes a greater load on the piping system and the treatment plant, when groundwater seeps through cracks in sewer pipes. In cases where sewer lines are placed below the water table, or when a rainfall leads to percolation down to the depth of the pipe, infiltration occurs; see *WATER*. The amount of storm water drainage to be carried away depends upon the intensity and duration of a rain-

SEWAGE DISPOSAL



This giant clarifier tank at a chemical plant in Louisville, Ky., has a capacity of 1,240,000 gal.; it separates wastewater by permitting solid waste to sink to the bottom while floating matter is skimmed off at the top. Both are then loaded on tanks, and transported to be used for sanitary landfill.

UPI

fall as well as upon the runoff or yield of the watershed; see DRAINAGE. In a metropolitan area only a small fraction of the rainfall seeps into the ground; the remainder flows from roofs, sidewalks and streets into storm sewers. An extremely wide range of flows, from none to many times the average daily flow of domestic and industrial sewage, can be expected.

A typical metropolitan area discharges a volume of wastewater approximately 60 to 80 percent of its total daily water requirements, the rest being used for washing cars, watering lawns, and manufacturing processes such as food canning and bottling. The hourly flow rate of sewage fluctuates from 40 percent to as high as 200 percent of the daily average.

Composition. The composition of wastewater is characterized by several physical, chemical, and biological measurements. The most common analyses include the measurements of solids, 5 day—20° C. biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), and pH.

The solid wastes include dissolved and suspended solids. Dissolved solids are the materials that will pass through a filter paper, and suspended solids those that do not; see FILTRATION. The suspended solids are further divided into settleable and non-settleable solids, depending on how many milligrams (mg) of the solids will settle to the bottom of a 1-liter (L) cone-shaped glass container in 1 hr. All these classes of solids can be subdivided into volatile or fixed solids, the volatile solids generally being considered to

be organic materials, and the fixed solids being inorganic or mineral matter.

The concentration of organic matter is measured by the BOD₅ and COD analyses. The BOD₅ is the amount of oxygen utilized over a 5-day period by microorganisms as they biochemically decompose the organic matter in sewage at a temperature of 20° C. Similarly, the COD, chemical oxygen demand, is the amount of oxygen required to oxidize the organic matter chemically to carbon dioxide and water; see OXIDATION. The values of these parameters, nevertheless, are usually not identical because there are materials which are not readily oxidized by biochemical means but which are easily oxidized chemically, and vice versa. The pH method is a measure of hydrogen ion (see ION) concentration of a wastewater sample. Typical values of solids, BOD₅, and COD for domestic wastewater are given in the accompanying Table 1:

Type of Solids	Solids mg/L			BOD ₅	COD
	Fixed	Volatile	Total	mg/L	mg/L
Suspended	70	175	245	110	108
Settleable	45	100	145	50	42
Non-settleable	25	75	100	60	66
Dissolved	210	210	420	30	42
Total	280	385	665	140	150

Table 1. Composition of a typical domestic sewage.

The organic matter in typical domestic sewage is approximately 50 percent carbohydrates, 40 percent protein, and 10 percent fat, while the pH may range from 6.5 to 8.0.

The composition of industrial waste can not be readily characterized by a typical range of values because its makeup depends upon the type of manufacturing process involved. The concentration of an industrial waste is usually placed in perspective by stating the number of people, or population equivalent (P.E.), that would be required to produce the same quantity of waste. A comparison may be made on the basis of solids, BOD₅ or COD measurements, but P.E. is most commonly expressed in terms of BOD₅. An average value of 0.17 lb. 5-day, 20° C. BOD per person per day is used for determination of the P.E. The population equivalent of a slaughterhouse operation, for example, will range from 5 to 25 P.E. per animal.

The composition of infiltration depends on the nature of the groundwater which seeps into the sewer. Storm water sewage contains significant concentrations of bacteria, trace elements (qq.v.), oil, and organic chemicals. The concentrations are highest when an intense rainfall of short duration occurs in the summer months after a sustained dry period.

HISTORY

Methods of waste disposal date back to ancient times, and sanitary sewers have been found in the ruins of the prehistoric cities of Crete and the ancient Assyrian cities. Storm-water sewers built by the Romans are still in service today. Although the primary function of these was drainage, the Roman practice of dumping refuse in the streets caused significant quantities of organic matter to be carried along with the rain-water runoff. The development of vault toilets occurred at the end of the Middle Ages, followed by the renewal of storm-sewer construction a few centuries later. At first it was forbidden to dispose of personal and household waste in the storm sewers, but by the 19th century it was recognized that community health could be improved by discharging human waste into the storm sewers for rapid removal. The development of municipal water-supply systems and household plumbing, furthermore, brought about flush toilets and the beginning of the modern sewer systems.

At the beginning of the 20th century, a few cities and industries began to recognize that the discharge of sewage directly into the streams caused health problems, and this led to the construction of sewage-treatment facilities. At about the same time, the septic tank was introduced as a means of treating domestic sewage from individual households both in suburban and rural areas. Because of the abundance of diluting water and the presence of sizable social and economic problems during the first half of the 20th century, very few municipalities and industries were compelled to provide wastewater treatment.

During the 1950's and 1960's, the government encouraged the prevention of pollution by providing funds for the construction of municipal waste-treatment plants, water-pollution research, and technical training and assistance. New treatment processes, methods for characterizing wastewater, and means for evaluating the effect of pollution on the environment were developed, but in spite of these efforts, expanding population and industrial and economic growth caused the difficulties to increase.

The magnitude of the pollution problem in the late 1960's and early 1970's has marked the beginning of a new era. It is an era of environmental awareness, cooperative and interdisciplinary efforts to solve problems, legislative action to improve the environment, application of advanced technology to waste treatment, and unprecedented industrial and economic involvement.

TRANSPORT OF WASTEWATER

The transport of wastewater from its source to a treatment facility is carried out by a pipe system which is generally classified according to the type of wastewater flowing through it. If the system carries both domestic and storm water sewage it is called a combined system, and these usually serve the older sections of urban areas. As the cities expanded and began to provide treatment of sewage, sanitary sewage was separated from storm sewage by a separate pipe network. This arrangement, which resulted in what is called a separate sewer system, is more efficient because it excludes the voluminous, dilute, storm sewage from the plant. It permits flexibility in the manner of treatment and discharge to the watercourses.

Sanitary Sewers. Households are usually connected to the sewer mains by 3- to 4-in. diameter clay or cast-iron pipe. The sewer mains may be located along the centerline of a street or alley about 6 ft. or more below the surface. The mains range in size from 8 in. to several feet in diameter. The pipes of smaller sizes are usually made of clay, concrete, or asbestos cement, and the large pipes are generally of unlined or lined reinforced-concrete construction. Unlike the water-supply system, the wastewater flows through sewer pipes by gravity (q.v.) rather than by pressure. The pipe must be sloped to permit the wastewater to flow at a velocity of at least 1.5 ft. per sec., as at lower velocities, the solid material tends to settle in the pipe. Storm-water mains are similar to sanitary sewers except that they have a much larger diameter.

The sewer mains from a section of a metropolitan area discharge into a single large pipe called an interceptor sewer. An interceptor transports the wastewater in the direction of the treatment plant. Several interceptors may join to form a so-called trunk line which discharges into the wastewater-treatment plant. Interceptors and trunk lines are large enough for workmen to walk in and some cities have pipes of diameters that allow the passage of a truck. They are generally made of brick or reinforced concrete (prefabricated or cast in place), and the cross-sectional geometry is usually egg-shaped, horseshoe-shaped, circular, or rectangular.

WASTEWATER TREATMENT

The processes involved in municipal wastewater treatment plants are usually classified as being part of primary, secondary, or tertiary treatment.

Primary Treatment. The wastewater that enters a treatment plant may contain logs, cans, twine, and other debris that might clog or damage the pumps and machinery. Such materials

SEWAGE DISPOSAL

are removed by screens of vertical bars, and the debris is burned or buried after manual or mechanical removal. The wastewater then passes through a comminutor or grinder, where leaves and other organic materials are reduced in size for efficient treatment and removal in subsequent processes.

GRIT CHAMBER. In order to remove the inorganic or mineral matter such as sand, silt, gravel, and cinders, the flow is routed through a long, narrow channel known as the grit chamber. The channel is designed so that a flow-through velocity of about 1 ft. per sec. is achieved, which permits inorganic particles 0.2 mm or larger to settle at the bottom while the smaller particles and most of the organic solids that remain in suspension pass through. Mechanical scrapers, moving along the bottom of the channel, rake the grit to one end of the chamber where it is removed and disposed as sanitary land fill. Grit accumulation can range from 3 to 8 cu.ft. per 1,000,000 gal. of wastewater.

SEDIMENTATION. With grit removed, the wastewater passes into a so-called sedimentation tank, which separates the settleable organic materials from the sewage by means of sedimentation. Large mechanical scrapers at the bottom of the tank rake the accumulation to one end of the tank for drawoff and disposal, and many tanks are also equipped to remove grease, scum and floatable materials by skimming them to a surface drawoff box at the effluent end. Retention or residence times average 1 to 3 hr., and sedimentation is capable of removing about 20 to 40 percent of the BOD₅ and 40 to 60 percent of the suspended solids.

The rate of sedimentation is increased in some industrial waste-treatment situations by incorporating processes called chemical coagulation and flocculation along with the sedimentation tank. Coagulation is the process of adding chemicals such as aluminum sulfate, ferric chloride, or polyelectrolytes to the wastewater, causing the surface characteristics of the suspended solids to be altered, and causing the solids to attach to one another. Flocculation is the operation that causes the suspended solids to coalesce. Coagulation and flocculation can lead to the removal of suspended-solids in excess of 80 percent.

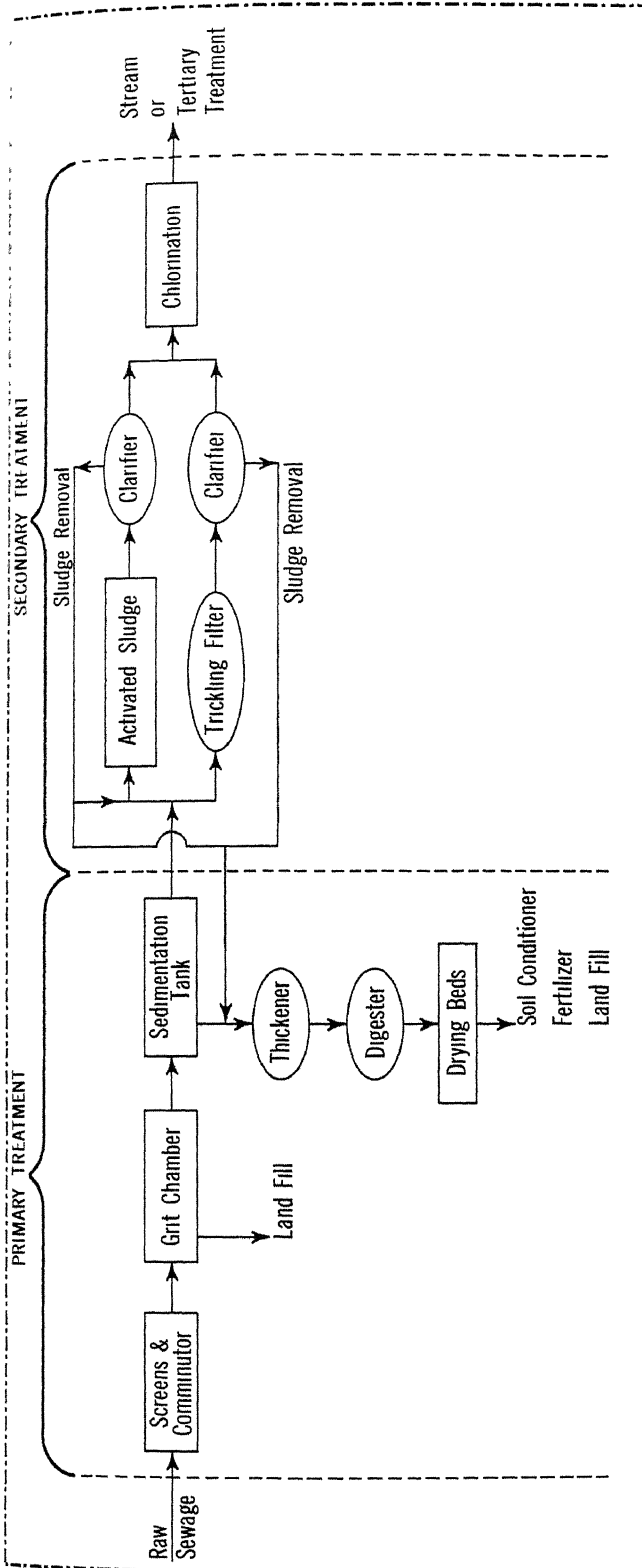
FLOTATION. An alternative to sedimentation that is used in the treatment of some wastewaters is flotation, in which air is dissolved or absorbed into the wastewater under pressures of 25 to 50 lb. per sq.in. The wastewater, supersaturated with air, is then discharged into an open tank, where the excess air rises like carbon dioxide in

a soft drink bottle. The rising air bubbles envelop them to rise to the surface, where they are removed. Flotation can remove more than 75 percent of the suspended solids.

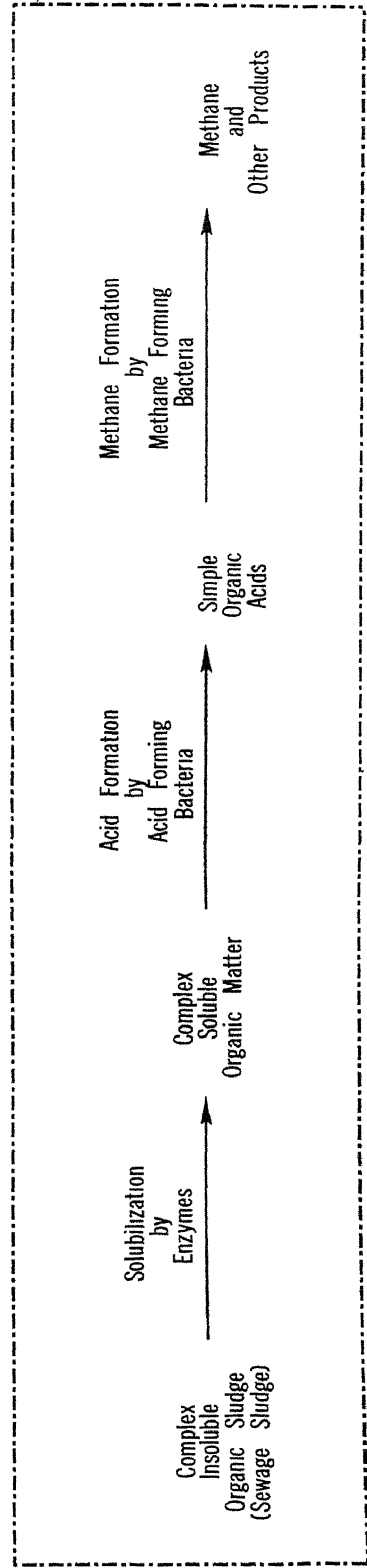
DIGESTION. Digestion is a microbiological process which converts the chemically complex organic sludge to methane, carbon dioxide, and an inoffensive humus-like material. The reactions occur in a closed tank or digester that is anaerobic, that is, devoid of oxygen. The conversion takes place through a series of reactions that follow one after the other. First the solid matter is solublized by enzymes (q.v.), followed by fermentation by a group of acid-producing bacteria, reducing it to simple organic acids such as acetic acid (q.v.). The organic acids are then converted to methane (CH₄) and carbon dioxide (CO₂) by bacteria. Thickened sludge is heated and added as continuously as possible to the digester, where it is detained for 10 to 30 days, and decomposed. The contents are kept partially mixed by (1) compressing the gaseous products (methane and carbon dioxide), and passing them back through the sludge either from outlets in the bottom or at an intermediate depth, (2) drawing sludge off the bottom and pumping it back into the top of the digester, and (3) by mechanical mixing. The rates of biochemical reactions going on inside bacterial cells increase with temperature, and thus digesters are operated at higher temperatures. Temperatures of 90 to 95° F. are achieved by utilizing the fuel value of methane gas, a by-product of the sludge-decomposition reaction. Digestion yields a 45 to 60 percent reduction in organic matter, the rest being an inoffensive humus.

DRYING. Digested sludge is placed on sand beds for air drying. Percolation into the sand and evaporation are the chief processes involved in the dewatering process. Air drying requires dry, relatively warm weather for greatest efficiency, and some plants have a greenhouse-like structure to shelter the sand beds. Dried sludge in most cases is used as a soil conditioner, or sometimes, as a fertilizer because of its 2 percent nitrogen and 1 percent phosphorus content.

OTHER METHODS. Another method of sludge treatment is wet-air oxidation, also known as the Zimmerman process. It is a physico-chemical process in which sludge is oxidized by air at high temperature (500 to 600° F.) and pressure (1600 to 1800 lb. per sq.in.). Residence times of 10 to 30 min. permit COD reductions ranging from 70 to 95 percent. Other sludge dewatering



FLOW DIAGRAM OF A TYPICAL SEWAGE TREATMENT PLANT



ANAEROBIC REACTIONS OCCURRING IN THE DIGESTION PROCESS

SEWAGE DISPOSAL

methods are vacuum filtration and centrifugation; see CENTRIFUGE. Vacuum filtration withdraws water under vacuum conditions, and uses a vacuum filter, which is a cylindrical drum covered with a filter medium and submerged in a slurry feed tank. A typical vacuum filter can de-water 500 to 3000 lb. (dry weight) of sludge per hr. to a solids content of 20 to 40 percent.

Secondary Treatment. Having removed 40 to 60 percent of the suspended solids and 20 to 40 percent of the BOD₅ in primary treatment by physical means, the secondary treatment biologically reduces the organic material remaining in the liquid stream. Usually the microbial processes employed are aerobic, that is, the organisms function in the presence of dissolved oxygen. Secondary treatment actually involves harnessing and accelerating nature's process of waste disposal. Aerobic bacteria in the presence of oxygen convert organic matter to stable forms such as carbon dioxide, water, nitrates, and phosphates, as well as other organic materials. The production of new organic matter is an indirect result of biological treatment processes, and must be removed before the wastewater is discharged into the receiving stream. The efficiency of a secondary treatment process is always based on the process being preceded by sedimentation and followed by a secondary clarifier.

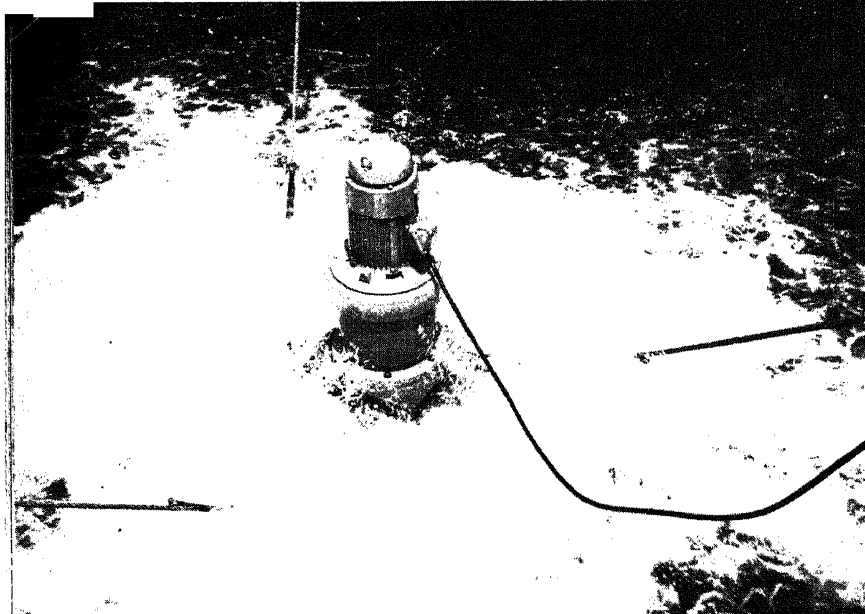
Several alternative processes are also available in secondary treatment, including trickling filter, activated sludge, and lagoons.

TRICKLING FILTER. In this process, a waste stream is distributed intermittently over a bed or column of some type of porous media. A gelatinous film

of microorganisms coat the media and function as the removal agent. Air permeates the pore spaces in the media and provides adequate oxygen to the organisms in the film. As the organic matter in the waste stream comes into contact with the microbial film, it is adsorbed and converted to carbon dioxide, water, and additional microbial film. The film accumulates until hydraulic flushing action of the waste stream flowing down through the bed causes bits and pieces of the film to detach from the media, these bits and pieces being removed prior to discharge of the liquid stream. The trickling-filter process, when preceded by sedimentation, can remove about 85 percent of the BOD₅ entering the plant.

ACTIVATED SLUDGE. This is an aerobic process in which organic pollutants are contacted with suspended gelatinous sludge particles. The particles are simultaneously suspended in an aeration tank and supplied with oxygen by means of pressurized gas or mechanical aeration. The activated-sludge process derives its name from the nature of the sludge particles, which are commonly referred to as floc. The floc are composed of millions of actively growing bacteria, and a gelatinous slime bonds the organisms together, yielding a floc particle several millimeters in diameter. Organic matter is sorbed by the floc and converted to aerobic products, including new cells. Activated-sludge tanks are usually rectangular, but sometimes circular, the dimensions varying with the size of the city served. The reduction of BOD₅ fluctuates between 60 and 85 percent.

An important companion unit in any plant



Electrically powered surface aerators, mounted on a fiber glass float and shown here in operation, are used for sludge treatment in basins or lagoons where stationary or diffused aeration methods are impractical.

Yeomans Bros. Co.

employing activated sludge or a trickling filter is the secondary clarifier which separates the biological growth from the liquid stream before discharge; the efficiency of treatment drops sharply otherwise.

STABILIZATION POND OR LAGOON. Another form of biological treatment is the stabilization pond or lagoon, which requires large land area and thus is usually located in rural areas. Facultative lagoons, or those that function in mixed conditions, are the most common, being 2 to 5 ft. in depth, with a surface area of several acres. Anaerobic conditions prevail in the bottom region, where the solids are decomposed, while the region near the surface is aerobic, allowing the oxidation of dissolved and colloidal organic matter; see COLLOIDAL DISPERSION. Residence times may vary from 40 to 60 days and a reduction in BOD₅ of 75 to 85 percent can be obtained.

Tertiary Treatment. Tertiary treatment is necessary if the receiving stream requires a higher degree of treatment than the secondary process can provide, or if the final effluent is intended for reuse. Processes are available which remove more than 99 percent of the suspended solids and BOD₅. Furthermore, it is possible to reduce a significant fraction of the dissolved solids and nutrients by existing advanced methods. Mixed media filters and activated carbon adsorption can practically eliminate the BOD₅ and most of the refractory compounds. Dissolved solids are reduced by processes such as reverse osmosis and electrodialysis while ammonia stripping, denitrification and phosphate precipitation can remove nutrients. Application of these and other advanced waste treatment methods is likely to become widespread in the future. See ADSORPTION; OSMOSIS; PRECIPITATION.

SEPTIC TANK. A sewage treatment process commonly used to treat the domestic wastes from individual households is the septic tank, which is a concrete, cinder block or metal tank where the solids settle, and the floatable materials rise. The partially clarified liquid stream flows from a submerged outlet into laterals, which are sub-surface rock-filled trenches through which the wastewater can flow and percolate into the soil where it is oxidized aerobically. A typical tank may have a volume of from 200 to 1000 gal. Hydraulic residence times vary from 1 to 4 days while the floating matter and settled solids may be detained from 6 months to several years during which they are decomposed anaerobically.

Liquid Disposal. The ultimate disposal of the treated liquid stream is accomplished in several ways. Direct discharge into a receiving stream

or lake is the most commonly practiced means of disposal, and in dry climates, treated effluents are sometimes used to irrigate nonedible crops such as cotton, flax, and forest lands. A few industries produce highly concentrated waste brine, acidic, or caustic solutions which are discharged into a pervious strata several thousand feet below ground, the method being referred to as deep-well disposal. Perhaps the most efficient means of disposal is recycle and reuse. After sewage has been adequately treated it becomes a useful resource. Water reuse has been practiced in the pulp and paper, steel, petroleum, and other industries. Effluents from tertiary treatment facilities have been utilized for irrigating golf courses, and for the development of fishing and swimming lakes. S.P.G.

SEWALL, Samuel (1652–1730), American colonial jurist, born in Bishopstoke, England, and educated at Harvard University, Cambridge, Mass. From 1681 to 1684 he managed the only licensed press in Boston. In 1683 he became deputy to the general court for the settlement of Westfield in Massachusetts, and in 1684 he was named a magistrate of the Massachusetts Bay Colony. Sewall served as a judge at the colony's sensational witchcraft (q.v.) trials in 1692; nineteen people were condemned to death. Five years later Sewall publicly admitted his wrong decisions, the only judge involved to make such public statement of his error. Sewall was justice of the Massachusetts superior court from 1692 to 1718 and from 1718 to 1728 served as chief justice. His diary, a witty and perceptive chronicle, was published as part of the *Massachusetts Historical Society Collections* (3 vol., 1878–82).

SEWARD, William Henry (1801–72), American statesman, born in Florida, N.Y., and educated at Union College, Schenectady, N.Y. He served as governor of New York State from 1839 to 1842, supporting educational reform and public works. From 1843 to 1849 he was engaged in the practice of law, specializing in criminal and patent cases. He served in the United States Senate from 1849 to 1855, during which time he established an uncompromising antislavery policy. He was active in organizing the Republican Party, formed as a result of the Whig Party (qq.v.) split over the slavery issue. From 1861 to 1869 he served as secretary of state in the Republican administrations of President Abraham Lincoln and President Andrew Johnson (qq.v.). His perceptiveness and diplomacy in this office were to a large degree responsible for preventing European intervention during the American Civil War; see CIVIL WAR, THE AMERICAN. While secretary of state, Seward also advocated a pol-

SEWARD PENINSULA

icy of American expansion. Although he was unable to secure Congressional approval for the purchase of several islands in the Caribbean Sea or for the annexation of Hawaii, he did secure consent for the purchase of Alaska from Russia in 1867 for \$7,200,000. Alaska, considered by many to be an unwise purchase, was disparagingly called Seward's Icebox or Seward's Folly. **SEWARD PENINSULA**, peninsula of Alaska, extending into the Bering Sea, surrounded on the n. by Kotzebue Sound and Goodhope Bay and on the s. by Norton Sound. The peninsula is about 200 mi. long and about 140 mi. at its maximum width. The major industries are gold mining and animal trapping. The peninsula is also the site of military air bases and observation posts. The population of the region is sparse, and the principal settlement is the seaport Nome. The peninsula was named after the American statesman William Henry Seward (q.v.), who effected the purchase of Alaska from Russia in 1867.

SEWELLEL or **MOUNTAIN BEAVER**, species of heavy, almost tailless, burrowing rodent, *Aplodontia rufa*, native to the Pacific coast of North America. As the only survivor of the ancient rodent family Aplodontiidae, it is the oldest living rodent on earth. A nocturnal animal, it is not related to the beaver and resembles more a vole (qq.v.). The term "sewellel" derives from a Chinook (q.v.) Indian word for robe. Although the animal is also known as the mountain boomer and whistler, it is singularly silent by nature. The sewellel is about 1 ft. long with thick, dark fur, and small eyes and ears. It dwells in dense mountainous woods near water, in which it is a capable swimmer. Sewellels live and nest in labyrinthine tunnels that they burrow 2 ft. below the surface of the ground, and through which they travel to feed above ground on vegetation.

SEWERS. See SEWAGE DISPOSAL.

SEWING MACHINE, machine designed to join pieces of fabrics or leather by means of either a lock or a chain stitch. The lock stitch, which is used in most modern machines, is formed from two threads and the chain stitch from a single thread.

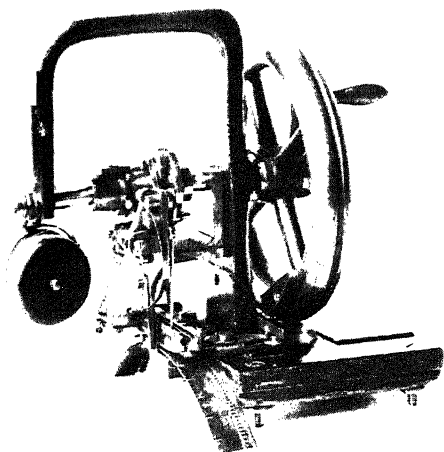
History. The first workable sewing machine was patented in 1790 by the British inventor Thomas Saint. Saint's machine used only a single thread and formed a chain stitch. No needle was used; instead an awl was employed to pierce a hole through the material being sewed. Another mechanism placed the thread over the hole and then a needlelike rod with a forked point carried the thread through to the under-

side of the work. Beneath the material a hook caught the thread and moved it forward a distance equivalent to the length of a single stitch. When the cycle was repeated a second loop was formed on the underside of the cloth within the first loop, thus forming a chain and locking the stitch. Saint's machine was designed for the sewing of leather and, except for its lack of a needle with an eye in the point, operated on the same general principle as the chain-stitch sewing machine still used today for sewing leather, canvas, and other heavy materials.

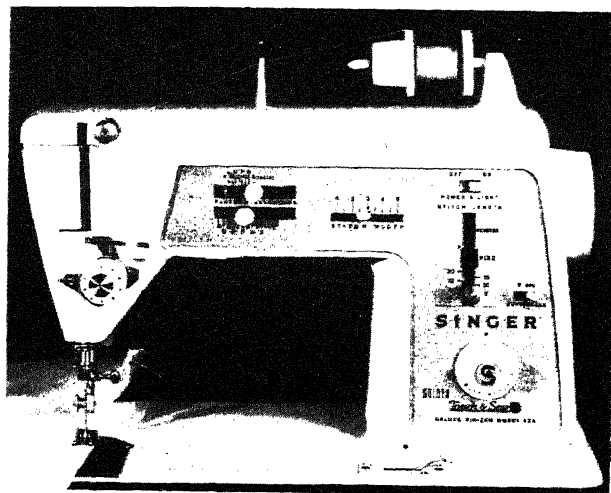
The first lock-stitch machine was devised by the American inventor Walter Hunt (1796-1859) and was first constructed about 1832. The machine, which employed both an eye-pointed needle and an oscillating shuttle, was not patented at the time of its invention and when Hunt later attempted to obtain a patent his claim was disallowed on grounds of abandonment. Working independently, the American inventor Elias Howe (q.v.) devised a machine which contained the same essential features as Hunt's and patented it in 1846. Subsequently another American inventor, Isaac Merrit Singer (1811-1875), patented a similar machine. He was sued by Howe for infringement of the latter's patent and ultimately lost his case. Singer, however, was instrumental in the pooling of various patents in the sewing-machine field and in laying the groundwork for the mass production of the machines. Other important inventions in the field included that of the rotary bobbin, which was incorporated into a machine patented by the American inventor Allen Benjamin Wilson (1824-88) in 1850, and the intermittent four-motion feed for advancing the material between stitches, which was part of the same patent. The presser foot, a spring-tension device for holding the material firmly against the worktable, was devised by Singer after the patenting of his first machine. The first fully practical chain-stitch sewing machine was the invention of the American James Ethan Allen Gibbs (1829-1902), who patented it in 1856.

The earliest successful sewing machines were powered by the turning of a hand crank. Later a foot-treadle and crank arrangement was used to permit the operator to use both hands in guiding the material under the needle. All modern sewing machines are now equipped with electric motors activated by means of foot-operated or knee-operated controllers.

Operation. Home sewers use either a straight-stitch or a zig-zag sewing machine. In straight stitching, the needle moves up and down, producing a straight line of stitches; in zig-zag



U.S. National Museum



Singer Co.

stitching, the needle moves up and down and side to side, resulting in a zig-zag line of stitching. The zig-zag machine is equipped for decorative stitching, monogramming, overcasting, blindstitching, sewing on buttons, making buttonholes, and mending. Most modern sewing machines employ two separate threads to form a special type of stitch known as the lock stitch. The upper thread is led through an eye formed near the point of a needle. The under thread is carried on a bobbin and is linked or locked to the upper thread by means of a rotary or horizontal motion of the bobbin. In a typical machine employing a rotary bobbin, the sequence of operations is as follows. The needle carrying the upper thread moves downward through the material being sewed, and the thread is engaged above the eye of the needle by a hook on the rim of the bobbin. As the bobbin turns, the upper thread is pulled out to form a loop through which the under thread feeds. The size of the loop is controlled by a tension device on the upper part of the machine. As the needle withdraws, the locked loop formed by the two threads is tightened by the pull of a lever take-up device to form a stitch. In a machine employing a horizontal bobbin held in a freely moving shuttle, the stitch formed is exactly the same. The shuttle moves through the loop of thread as the needle comes down, and then the shuttle returns to its original position as the needle moves up.

In addition to the large number of machines used for home sewing, about 2000 different types of sewing machines are manufactured for industrial use. These include machines for the manufacture of hats, shoes, and hosiery, as well as the sewing of garments.

SEX, physical difference which distinguishes organisms according to their functions in the re-

The sewing machine. Left: Elias Howe's machine, patented in 1846, was driven by a hand crank. Right: A modern high-speed lock-stitch machine that provides three types of stitches.

productive processes; see REPRODUCTION. This difference serves to classify the majority of plants and animals as male or female, depending on whether they produce functional spermatozoa or ova (in the case of animals), and whether they are equipped with the corresponding internal and external sex organs; see REPRODUCTIVE SYSTEM. Many lower organisms, such as the annelid worms and some gastropods, possess both male and female systems of reproduction, and are termed hermaphroditic; see HERMAPHRODITISM. Among colonial invertebrates there exist certain vegetative forms which possess no sex organs, and which serve merely to supply nourishment to the entire colony. These forms are often designated as "neuter". For a discussion of sex in the plant kingdom, see PLANT MORPHOLOGY.

In animals, the sex of an individual is generally determined at the time of the fertilization (q.v.) of the female egg, or ovum, by the male sperm, and is the result of certain sex-determining factors within the chromosomes of the parent sex cells. In some animals, however, the sex of the offspring may be changed by factors other than chromosomal influence through a phenomenon known as *sex reversal*; a sustained increase in the rate of metabolism favors the production of males, and a decrease in the metabolic rate is conducive to the development of females.

Aside from the primary sex organs, animals have secondary sexual characters which play no direct part in reproduction. Instances of male secondary characters are the long tail feathers and spurs of poultry, the mane of the lion, the

SEX EDUCATION

brilliant plumage of many birds, the throat pouch of some lizards, the tusks and antlers of certain ungulates, and the facial hair of man. These characteristics are for the most part absent in the corresponding females. In vertebrate animals the secondary sexual characters are largely under the control of hormones produced by the testes or ovaries, and the absence of the proper hormone at an early stage may prevent the development of the expected secondary features.

The sexes, in most animals, are specialized in function as well as in structure. Specific functions ranging from nest-building to parental care of the young, are usually relegated to either the male or female in accordance with learned or inherited patterns of the species.

SEX EDUCATION, program of instruction in subjects relating to human reproduction. The curriculum includes instruction in the male and female roles in marriage and reproduction, the social and psychological aspects of adolescence, family relationships, venereal disease, and animal biology.

A typical sex education program may begin at the kindergarten level with emphasis on the fact that all animals and people come into the world as babies; that baby animals and human babies develop from eggs, or ova; that animals always beget their own species; and that all girls grow into women and all boys grow into men. Children from the ages of seven to nine are instructed in the use of proper terminology for body parts, how to accept one's own sex identity, and about reproductive characteristics among different animal species. Beginning around the age of ten, sex-education classes are taught the physical changes that accompany puberty, the influences of heredity, the process of human fertilization, the development of the fetus, and how a baby is born. At about the age of twelve, sex-education emphasis is placed on the influence of the endocrine system (q.v.) on body functions and mental and emotional behavior, appropriate social behavior between boys and girls, and the hazards of indiscriminate relationships between the sexes. High-school level classes may include detailed instruction in prenatal care of the mother and baby, the purposes of reproduction for the species and society, and the social conventions of courtship and marriage.

Sex-education programs in the schools are best in those communities where they have come into existence through cooperation among parents, teachers, and such specialists as child psychologists, physicians, and ministers.

The presentation of material is geared to the physical age and mental maturity of the students. Specially prepared texts, pamphlets, and films, slides, and other visual aids are used. Teachers who instruct sex-education programs usually have special training and evidence a familiarity, respect, and ease with both the topic and the particular age group involved.

SEXTANT, optical instrument used for the measurement of angular distance between any two objects. The instrument was invented independently, in about 1730, by the English mathematician John Hadley (1682–1744) and the American inventor Thomas Godfrey (1704–49). The chief use of the sextant is in navigation (q.v.), for determining the elevation of the sun or other celestial bodies.

The operation of the sextant depends upon superimposition of the images of the two objects whose distance is being measured. This is achieved by means of an optical system consisting of a telescope and two mirrors, one fixed and one movable.

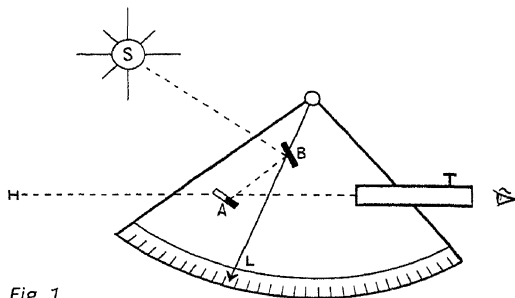


Fig. 1

telescope T is mounted in a fixed position on the body of the instrument, pointing toward the mirror A. The top half of this mirror is transparent and the bottom half is silvered. A second mirror, mirror B, is angled above mirror A. An observer looking through the telescope toward the horizon H sees the horizon through the unsilvered portion of mirror A, and at the same time sees the image of the star or the sun S on the silvered portion of mirror A, as rereflected from mirror B above. By then moving B by means of the lever L, the image of the star is brought into coincidence with the image of the horizon. The angular distance between the star and the horizon can then be read on a scale, which is engraved on the body of the sextant. This scale is an arc of one sixth of a circle or 60°. Each degree on the scale of the sextant is equivalent to two degrees of angular distance between the objects actually observed, because of the double reflections.



Navigator using sextant to measure angle of the sun above the horizon.
Don Selchow

When observations with sextants are taken aboard ships at sea, the actual observed horizon can be used for measuring altitudes. On land this method of observation is seldom possible, however, because of the irregularity of terrain. In this case a so-called artificial horizon is employed, consisting of a pool of mercury (q.v.) or some other horizontal reflecting surface. By observing the star itself and the image of the star in the mercury, a sextant reading can be obtained that is equal to double the actual altitude of the star.

A special type of sextant is the bubble sextant. In aircraft, and on ships in a rough sea, when the visible horizon is not a clearly defined line, use is made of bubble sextants or bubble octants. The octant is an instrument resembling a sextant, but having an arc of only one eighth of a circle or 45° . In these bubble instruments, the bubble of a built-in spirit level is observed in place of the horizon.

SEXUAL SELECTION, in biology, a special type of natural selection (q.v.) in which reproductive success among individuals is determined by the way in which mating occurs. Competition between individuals of the same sex for mates can favor individuals with certain hereditary characters, or traits. Because these characters are perpetuated only if reproduction is successful, their frequency tends to increase. Sexual selection results in morphological distinction of the sexes (sexual dimorphism) because one sex is selected for traits that are not required by the other. Examples include antlers on male deer, brightly colored patterns on male birds, and size differences between sexes.

There are two main forms of sexual selection—intrasexual selection and epigamic selec-

tion. In intrasexual selection males (or more rarely females) compete through display or physical contest for mates. In epigamic selection females accept males (or more rarely the reverse) with certain traits. In extreme instances individuals of one sex can monopolize many individuals of the other for mating purposes, thus creating especially intense sexual selection. See EVOLUTION.

SEYCHELLES, republic consisting of about eighty-six islands and islets in the Indian Ocean (q.v.), about 700 miles N.E. of the island of Madagascar. It is situated between lat. $3^\circ 40'$ S. and lat. $6^\circ 5'$ S. and between long. $53^\circ 55'$ E. and long. $59^\circ 10'$ E. The total area is 107 sq.mi. The main islands are Mahé (57 sq.mi.), Praslin (15 sq.mi.), Silhouette (8 sq.mi.), and La Digue (4 sq.mi.).

The islands are mountainous; the highest peak is Morne Seychellois (2993 ft.) on Mahé. The climate is tropical with temperatures ranging from about 74° F. to 86° F. and an average rainfall of 90 in. annually.

The population of the Seychelles (census 1971) was 52,650. The inhabitants of the islands speak a French patois. Victoria (pop., 1971, 13,736), on Mahé, is the capital and chief port.

The economy of the country is overwhelmingly agricultural and largely geared toward the export market. The chief products are copra and cinnamon bark and oil. The tourist industry is growing rapidly, and increasing amounts of fish are caught, mainly for local consumption. The unit of currency is the Seychelles rupee (6.43 rupees equal U.S.\$1; 1975).

Government. Under the 1976 constitution, the chief executive of the Seychelles is a popularly elected president. He is assisted by a cabinet headed by a prime minister. Legislative power is vested in a unicameral parliament, the National Assembly, consisting of twenty-five members, most of whom are elected by a system of proportional representation.

History. Possibly known to the Arabs as early as the 9th century A.D., the Seychelles were visited by the Portuguese in 1502. In 1756 France claimed the islands, which were then uninhabited, and French planters and their slaves settled on them beginning in 1768. In 1794 Great Britain annexed the Seychelles. The islands were administered from Mauritius during most of the 19th century, and in 1903 they were made a separate British dependency. On June 28, 1976, the Seychelles became an independent republic and a member of the Commonwealth of Nations. James Mancham became the first president.

SEYHAN. See ADANA.

SEYMOUR, name of an English family, important in history from the 13th century, bearing the titles earl and marquis of Hertford and duke of Somerset. Among the prominent members of the family are the following.

Edward Seymour, 1st Earl of Hertford and Duke of Somerset (1506?–52), protector of England (1547–50). Said to have attended both the universities of Oxford and Cambridge, he gained the favor of Henry VIII (q.v.), King of England, and was created earl of Hertford in 1537. When the king died in 1547, Seymour assumed the protectorate with the consent of the young successor, Edward VI (q.v.), who was Seymour's nephew. With almost absolute authority, he also assumed the title duke of Somerset. During his years as protector, he went to war against Scotland, winning the Battle of Pinkie in 1547; his influence brought Protestant reforms into the Church of England, including the adoption in 1549 of the *Book of Common Prayer* (q.v.); and his sympathy with the peasant class eventually led to his overthrow by John Dudley, Duke of Northumberland and Earl of Warwick (see under DUDLEY). Somerset was imprisoned by Northumberland in 1549, released in 1550, imprisoned again in 1551, and beheaded in 1552.

Jane Seymour (1509?–37), Queen Consort of England (1536–37) as the third wife of Henry VIII, King of England, the sister of Edward Seymour, born probably in Wiltshire. She was a lady in waiting to Catherine of Aragón and later to Anne Boleyn (qq.v.), the first two wives of Henry. Shortly after the execution of Anne Boleyn in 1536, Jane married the king. She died on Oct. 24, 1537, twelve days after the birth of her son, Edward, Henry's only male heir, later Edward VI, King of England.

SEYMOUR, Horatio (1810–86), American politician, born in Pompey, N.Y. Seymour served as military secretary to the governor of New York State William Learned Marcy (q.v.) from 1833 to 1838; as New York State assemblyman in 1841, 1844, and 1845; as mayor of Utica in 1842; and as governor of New York State in 1853–54 and again in 1863–64. His support for the North during the American Civil War was primarily territorial, as he was not in favor of such major issues as the emancipation of slaves or conscription (q.v.). After his placating speech to the mob at the 1863 draft riots (q.v.) in New York City, he was labeled one of the Copperheads (q.v.), a derogatory term applied to northerners who favored peace with the South. In 1868 he was unsuccessful as the Democratic Party (q.v.) Presi-

dential nominee, losing the election to the United States secretary of war, General Ulysses S. Grant (q.v.).

SFAX, city and port of Tunisia, on the Gulf of Gabès, an arm of the Mediterranean Sea, about 130 miles s. of Tunis. Sfax is a major seaport and exporting center. Among its industries are the manufacture of phosphate, olive oil, sponges, pistachio nuts, almonds, and wool. Sfax is divided into two parts, the Arab-inhabited section, which is surrounded by a high wall, and the modern, European section. During World War II, the strategically located harbor served as an important Axis base until its capture by Allied troops in 1943. Pop. (1971 est.) 100,000.

SFORZA, name of a family of Italian leaders who ruled the city of Milan in northern Italy during much of the 15th and 16th centuries. Among the more famous members of the family were the following.

Giacomuzzo Attendolo Sforza or Muzio Attendolo Sforza (1369–1424), founder of the Sforza family, born in Cotignola, Italy. Of peasant origin, he rose to the position of condottiere and added the name Sforza (It. *sforzare*, to "force") to his surname Attendolo. In 1410 he was given the lordship of Cotignola for his defense of the cities of Milan and Florence against Ladislas, King of Naples (1379?–1414). In 1411, however, Giacomuzzo joined with Ladislas, supporting him in subsequent military campaigns. After the king's death, he served the queen of Naples, Joanna II (1371–1435).

Francesco Sforza (1401–66), Duke of Milan, son of Giacomuzzo. He joined the service of the duke of Milan, Filippo Maria Visconti (1392–1447) and, in 1441, married the duke's daughter, Bianca Maria Visconti (1423–68). At the death of the duke, struggles to control Milan ensued until, in 1450, Francesco seized the city. He helped effect the unification of Milan with its former enemies Naples and Florence through a triple alliance signed in the mid-15th century at Naples. In 1459 he assisted Ferdinand I, King of Naples (see under FERDINAND) in his struggle for the throne against the French claimant, Jean d'Anjou (fl. 15th cent.).

Galeazzo Maria Sforza (1444–76), Duke of Milan, son of Francesco. He was responsible for renewed friction among the Italian states by establishing an anti-Venetian policy. His marriage to the French noblewoman Bona of Savoy, sister-in-law of Louis XI (q.v.), King of France, and a determined enemy of Venice, further cemented this feeling. Although he was a cultured man and a patron of the arts, Sforza's despotic rule caused a small group of Milan citizens to

assassinate him with the hope of freeing the city. The dukedom passed to his son, Giangaleazzo Sforza (1469–94), who, only seven years of age, was unable to prevent Galeazzo's brother, Lodovico Sforza (see below), from gradually taking control of Milan.

Lodovico Sforza or Ludovico Sforza, known as IL MORO (1451–1508), Duke of Milan, son of Francesco. In 1479 he seized the title from his nephew, Giangaleazzo, but he was not officially acknowledged as duke until 1494. His rule fostered tremendous accomplishments in the arts and sciences and he became the patron of such distinguished men as the Florentine master, Leonardo da Vinci (q.v.). His political activities, however, were disastrous to Italy. Under his rule, Naples once again became an enemy of Milan. Lodovico, fearing a threat to his power by the strengthening alliance between his nephew and the king of Naples, the result of Giangaleazzo's marriage in 1489 to the king's niece, banished his nephew to Pavia, a province in northern Italy. Giangaleazzo died there shortly thereafter. In 1494 Lodovico abetted Charles VIII, King of France (see under CHARLES) in his plans to conquer Naples, and the French invaded Italy. In 1495, realizing the potential power of the invaders, Lodovico rejoined his Italian neighbors and successfully routed the French troops from Italy. The succeeding French monarch, Louis XII (q.v.), seeking a stronghold on the Italian peninsula, invaded and conquered Milan in 1499. Lodovico fled to Germany. He returned to Italy a year later with new troops but was captured and taken as a prisoner to France, where he died.

Massimiliano Sforza (1491–1530), Duke of Milan, eldest son of Lodovico. At the end of Lodovico's reign, Milan became one of the most important spoils in the struggles between France and the Holy Roman Empire. The Swiss at first supported France in her attempts to dominate Italy. In 1512, however, the Swiss sought to control Milan themselves. They helped drive the French out of Italy and set up Massimiliano as duke of Milan. Massimiliano ruled under Swiss control until 1515, when the Swiss were defeated by the French at the town of Marignano (now Melegnano) in northern Italy. Massimiliano surrendered the duchy to Francis I (q.v.), King of France.

Francesco Maria Sforza (1492–1535), Duke of Milan, son of Lodovico. In 1522 Charles V (q.v.), Holy Roman Emperor, defeated the French and Swiss at La Bicocca, a village north of Milan, and subsequently restored the dukedom to Francesco Sforza. Sforza, however, seeking to lessen

Spanish influence in Italy, joined with France, Venice, Florence, and the Pope in the League of Cognac (1526), directed against Spain. By the Treaty of Cambrai (1529), however, Spain remained an important power in Italy. Francesco was the last in the male line of the Sforza family, and, after his death, the city came under the rule of Charles V.

SFORZA, Count Carlo (1873–1952), Italian statesman, born in Montignoso di Lunigiana, Italy. In 1896 he entered the diplomatic service, and in 1919 he became a senator. He was appointed ambassador to France in 1922 but resigned after two months in protest against the policies of the new Italian premier Benito Mussolini (q.v.). Sforza then led the democratic opposition against the Mussolini dictatorship. In 1928 he left Italy but continued his fight against Fascism (q.v.) while living abroad. He returned in 1943, after the downfall of the Mussolini government. In 1944, he served as minister of state without portfolio. In 1945 he was elected president of the consultative assembly, which helped organize the new Italian government, and from 1947 to 1951, he was foreign minister. Sforza played an important role in the post-World War II peace treaty negotiations between Italy and the Allied countries. Among his works are *Makers of Modern Europe* (1930), *Contemporary Italy* (1944), and *Italy and the Italians* (1948). See also ITALY: History: World War II.

'S GRAVENHAGE. See HAGUE, THE.

SHABUOTH or SHAVUOTH, also FEAST OF WEEKS or PENTECOST, Jewish holiday. It is celebrated in the late spring during the Hebrew month of Sivan, seven weeks after Pesach (q.v.), or Passover. In Biblical times the festival was a thanksgiving for the grain harvest. Later tradition associates the holiday with the giving of the Law (see DECALOGUE) on Mt. Sinai. Shabuoth observances include the reading of the book of Ruth (q.v.) and the decoration of the home and synagogue (q.v.) with greens. In addition a dairy meal, symbolic of "milk and honey", is eaten.

SHACKLETON, Sir Ernest Henry (1874–1922), British explorer, born in Kilkee, County Clare, Ireland. He joined the British merchant navy in 1890 and in 1901 sailed on his first expedition to Antarctica, with the British explorer Robert Falcon Scott (q.v.). In 1907 Shackleton commanded the first announced attempt to reach the South Pole. He came within a record-breaking 97 mi. of his goal on Jan. 9, 1909, reaching lat. 88°23' S. His party also succeeded in climbing the 13,200-ft. Mt. Erebus (q.v.). Upon his return that year Shackleton was knighted. From 1914 to 1916 he attempted to reach the Ross Sea, an arm

SHAD

of the southern Pacific Ocean, from the Weddell Sea, an almost opposite arm in the southern Atlantic Ocean, by crossing the Antarctic Continent; the expedition was unsuccessful. In 1921 Shackleton undertook his final voyage, a 30,000-mi. journey in the southern Atlantic Ocean but died before the expedition could be completed. His writings include *Heart of the Antarctic* (1909) and *South* (1919), accounts of his expeditions. See ANTARCTICA: *Exploration*.

SHAD, genus of fishes of the family Clupeidae, related to the herring, sardine, menhaden, and alewife. Shad inhabit the sea, but ascend rivers to spawn in fresh water. The eggs are small, heavy, and nonadhesive. The common shad or allice shad, *Alosa communis*, is rather thicker and deeper in proportion to its length than the herring. A species of shad, *A. sapidissima*, generally weighing about 4 or 5 but sometimes 12 lb., is very abundant during certain months of the year in some of the North American rivers, as the Hudson, Delaware, Susquehanna, and Saint Lawrence, and is now bred successfully in large numbers in the United States.

SHADBUSH, common name applied to shrubs and low trees constituting the genus *Amelanchier* of the Rose family, Rosaceae. The genus, which contains about twenty-five species also known as shad-blow, service, serviceberry, and Juneberry, is chiefly native to North America; several species are cultivated in northern and eastern United States for their edible fruits. Shadbushes have simple leaves which are often coated with soft, silvery fuzz. The white flowers, which are borne in racemes, and which appear in early spring, have a five-cleft calyx, five petals, many stamens, and a single pistil. The sweet, usually edible, purplish fruit is a ten-celled, berrylike pome, which ripens in June or July. The common shadbush of eastern U.S. is *A. canadensis*, which grows to a height of about 40 ft. Another widely distributed shadbush is *A. stolonifera*, which attains a height of about 4 ft.

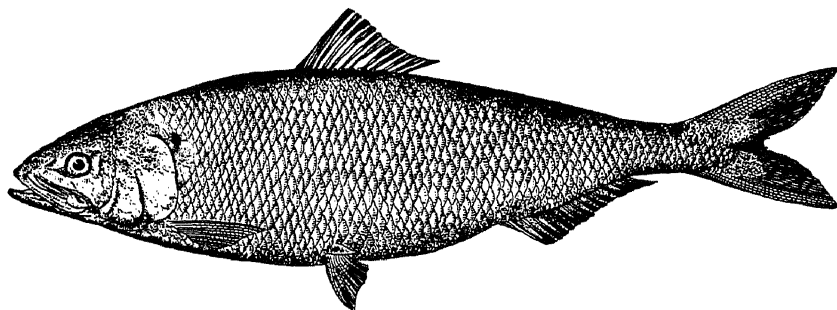
SHADDOCK, tree, *Citrus grandis*, of the Rue family, Rutaceae, which, like other species of

the same genus, is native of the Republic of Indonesia, and which has long been cultivated in southern Europe. It is readily distinguished from most of its congeners by large leaves and broad-winged leafstalk; it has very large white flowers, and the fruit is also very large, sometimes weighing 10 or even 14 lb., roundish and pale yellow; the rind, thick, white, and spongy within, is bitter; the pulp is greenish and watery, subacid, and subaromatic. It is a pleasant, cooling fruit, and much used for preserves. Finer and smaller than the shaddock proper is the pomelo, also called pummelo and grapefruit, a variety larger than an orange which bears its fruit in clusters.

SHADOW MOUNTAIN NATIONAL RECREATION AREA, recreational area 5 miles N.E. of Granby, Colo., forming part of the Colorado-Big Thompson Project, a vast water-diversion system that carries water for irrigation over the Rocky Mts. to eastern Colorado. The Shadow Mountain recreation area adjoins the western entrance to Rocky Mountain National Park (q.v.) and surrounds Lake Granby and Shadow Mountain Lake at the junction of the north and south forks of the Colorado R. It is administered by the National Park Service (q.v.).

SHADWELL, Thomas (1642?-92), English dramatist and poet, born in Norfolk and educated at the University of Cambridge. He practiced law until the successful production of his comedy *The Sullen Lovers* (1668), after which he devoted himself entirely to writing. Shadwell produced chiefly comedies in which he criticized the manners of the period. His best-known plays are *Epsom Wells* (1672) and *The Squire of Alsatia* (1688). In the last decade of his life Shadwell openly acknowledged his literary feud with the English poet John Dryden (q.v.), then the poet laureate and historiographer of England. His satire *The Medal of John Bayes* (1682) contains his strongest attack against Dryden, who counteracted with *MacFlecknoe, or a Satire on the True Blue Protestant Poet, T.S.* (1682). Shadwell succeeded Dryden as poet laureate in 1688.

Shad, Alosa sapidissima



SHAEF, popular designation for the Supreme Headquarters, Allied Expeditionary Forces of World War II (q.v.), which was located in England and directed the Allied western offensive against Germany. The military personnel of SHAEF consisted of representatives of the United States, Great Britain, and France. The supreme commander was the U.S. general and later President Dwight David Eisenhower (q.v.). Plans for the successful invasion of France, which at the time was occupied by German forces, were formulated at SHAEF in 1944. The establishment was officially dissolved in July, 1945, after the end of the war in Europe.

SHAFTER, William Rufus. See SANTIAGO, BATTLE OF; SPANISH-AMERICAN WAR.

SHAFESBURY, earldom of the English peerage held by members of the Cooper family. Among the more famous members holding this title are the following.

Anthony Ashley Cooper, 1st Earl of Shaftesbury (1621–83), statesman, born in Wimborne Saint Giles, Dorsetshire. He served in the Short Parliament in 1640, switched his political support to King Charles I (q.v.) and the Royalists at the start of the Great Rebellion (q.v.), and then rejoined the Parliamentarians in 1644. In 1653 he was appointed a member of the Barebone's Parliament (q.v.). A strong advocate of parliamentary government, he came to oppose the autocratic administration flourishing under Oliver Cromwell (see under CROMWELL), Lord Protector of England. After Cromwell's death in 1658, Cooper was influential in the Restoration of Charles II (qq.v.) as king of England.

Cooper subsequently became an important member of the so-called Cabal, an elite advisory group serving King Charles. In 1660, he was made privy councillor and in 1661 was appointed chancellor of the exchequer. In these roles he made significant strides toward eliminating the problems of commerce and colonization. In 1672 he was created earl of Shaftesbury, this appointment resulting primarily from his support of the king and his approval of the Crown's Declaration of Indulgence, a document suspending all laws penalizing Roman Catholic recusants and Protestant dissenters. In 1673, fearing the king's efforts to promote the status of Roman Catholicism in England, Cooper renounced his earlier position of religious toleration and gave his support to the anti-Catholic Test Acts (q.v.). He was dismissed from office in 1673 and in 1678 supported the Popish Plot; see OATES, TITUS. Cooper opposed the Catholic James, Duke of York (see JAMES II) as heir to the throne, supporting instead the Protestant James

Scott, Duke of Monmouth (q.v.). In 1681 Cooper was charged with treason but was subsequently released and fled to Holland. He was scathingly satirized by his contemporary John Dryden (q.v.), then poet laureate of England, in the allegorical poem *Absalom and Achiophel* (1681).

Anthony Ashley Cooper, 3rd Earl of Shaftesbury (1671–1713), philosopher, grandson of the 1st Earl, born in London. He served in Parliament for the borough of Poole from 1695 to 1698, following a liberal Whig (q.v.) policy. Shaftesbury considered nature a perfect harmonious whole that reflected its divine origin. He introduced the term "moral sense" by which he meant a special ability inborn in man that naturally allows him to be ethical and good. Shaftesbury's philosophical writings were collected in *Characteristics of Men, Manners, Opinions, and Times* (3 vol., 1711).

Anthony Ashley Cooper, 7th Earl of Shaftesbury (1801–85), philanthropist, a lineal descendant of the above, born in London, England. He entered Parliament in 1826 as a Conservative member for the borough of Woodstock and, from 1831 to 1846, represented Dorsetshire. An important force in early British reform legislation, Shaftesbury was instrumental in the passage of laws prohibiting the employment of women and children in coal mines (1842), reforming the care of the insane (1845), and establishing a ten-hour day for factory workers (1847). He promoted the construction of model tenements for the deprived and schools, called ragged schools, for the neglected poor children.

SHAHAPTIAN, family of North American Indian languages spoken by tribes found along the Columbia R. and in adjoining parts of Washington, Idaho, and Oregon. Shahaptian-speaking tribes include the Nez Percé, Umatilla, Wallawalla, and Yakima (qq.v.). See AMERICAN INDIANS: *Indians of the United States and Canada*.

SHAHARIT. See PRAYER, JEWISH.

SHAHAT. See CYRENE.

SHAH JAHAN. See INDIA: *History: The Mogul Empire*; TAJ MAHAL.

SHAHN, Ben(jamin) (1898–1969), American artist, born in Kaunas, Russia (now in the Lithuanian S.S.R.), and brought to the United States in 1906. He attended New York University, the Art Students League of New York, and the National Academy of Design, and supported himself as a lithographer until 1930. In that year he held his first one-man show in New York City.

Shahn made his early impact as a painter with a series of two large panels and twenty-three small gouaches (1931–32; Whitney Museum of

SHAKER HEIGHTS

American Art, New York City) on the Sacco and Vanzetti case (q.v.), which concerned the controversial conviction of the two men for murder. These works were the first of many by Shahn classified as social realism, that is, paintings characterized by the social, usually liberal, attitude of the painter. He often painted immigrants, the poor, sweatshops, and unflattering portraits of politicians.

A commercial artist as well as an easel painter and muralist, Shahn is credited with raising the standards of commercial art with his illustrations, posters, and advertisements. His work is notable for its strong, flat color and clear, incisive line. Important retrospective exhibitions of his work were held at the Museum of Modern Art, New York City, in 1947 and at the Biennale in Venice, Italy, in 1954. His book *The Shape of Content* (1957), which expresses Shahn's philosophy of art, is a collection of lectures he delivered at Harvard University as Charles Eliot Norton Professor in 1956.

SHAKER HEIGHTS, city of Ohio, in Cuyahoga Co., adjoining Cleveland and 8 miles s.e. of the downtown section. North Union was founded on the site in 1827 by a community of Shakers, and was disbanded in 1889. Shaker Heights was founded in 1905 and was incorporated as a village in 1912 and as a city in 1931. Pop. (1960) 36,460; (1970) 36,306.

SHAKERS, name applied to The United Society of Believers in Christ's Second Coming, a

sect first heard of about 1750 in Great Britain. The first leaders were James Wardley, or Wardlaw, a tailor, and Jane, his wife, seceders from Quakerism (see FRIENDS, SOCIETY OF) who had come under the influence of a group of preachers and workers of alleged miracles known as the "French Prophets". Jane, especially, claimed to have special spiritual illumination and to have "received a call" to go forth and testify for the truth. From the peculiar trembling of the secessionists at their meetings came the name Shaking Quakers or Shakers.

In 1774, Ann Lee (1736–84), of Manchester, England, introduced the sect in America, establishing the first community in what is now Watervliet, N.Y., in 1776. She was known to her followers as Mother Ann and regarded by them to be a female counterpart of Jesus Christ. Shakerism flourished, and by 1826 there were 18 new communities with a membership of about 6000. These communities held property in common, practiced asceticism, and honored celibacy above marriage. The movement diminished after 1860, and in the early 1970's there were only 14 remaining members living in two communities, Sabbathday Lake, Maine, and Canterbury, N.H. No new members were accepted after 1964. At Harvard, Mass., site of a former Shaker community, an exhibit of the simple, well-made furniture and utensils produced by the communities is maintained by the Fruitlands Museum Group. Hancock Shaker Village, which includes restored buildings and art collections, is located outside Pittsfield, Mass.

Shakers dancing during a meeting near Lebanon, New York, about 1825.

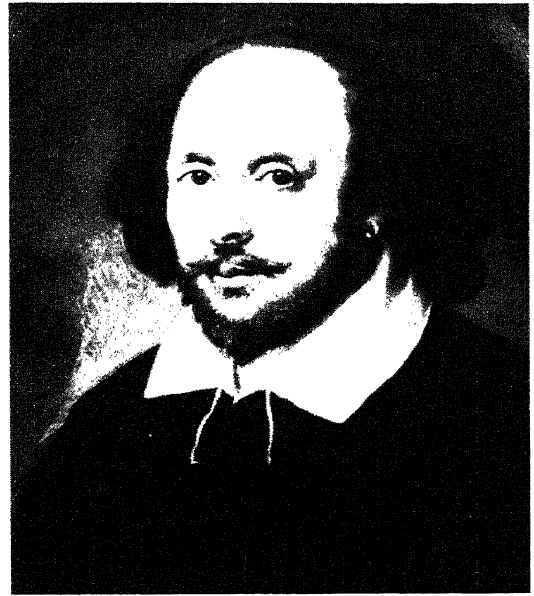
Museum of Modern Art



"English Shakers" was the name given to a community calling themselves "Children of God", founded by the British religious leader Mary Anne Girling (1827–86) about 1864. On her death the sect collapsed.

SHAKESPEARE, William (1564–1616), English poet and playwright, recognized as the greatest of English dramatists, born in Stratford-on-Avon, Warwickshire. The third of eight children, he was the eldest son of John Shakespeare (d. 1601), a locally prominent merchant, and Mary Arden (d. 1608), daughter of a Roman Catholic member of the landed gentry. He was educated probably at the local grammar school. As the eldest son of the family, Shakespeare ordinarily would have been apprenticed in his father's shop so that he could learn and eventually take over the business, but according to one tradition he was apprenticed to a butcher because of reverses in his father's financial situation. According to another account he became a schoolmaster. That Shakespeare was allowed considerable leisure time in his youth is suggested by the fact that his plays show more knowledge of hunting and hawking than do those of any other contemporary dramatist. In 1582 he married Anne Hathaway (q.v.), the daughter of a farmer. He is supposed to have left Stratford after he was caught poaching in the deer park of Sir Thomas Lucy (1532–1600), a local justice of the peace.

Shakespeare apparently arrived in London about 1588, and by 1592 he had attained success as an actor and a playwright. Shortly thereafter he secured the patronage of Henry Wriothesley, 3rd Earl of Southampton (1573–1624). The publication of his two fashionably erotic narrative poems *Venus and Adonis* (1593) and *The Rape of Lucrece* (1594) and of his *Sonnets* (published 1609, but circulated previously in manuscript) established his reputation as a true poet in the Renaissance manner. The *Sonnets* describe the devotion of a character, often identified with the poet himself, to a young man whose beauty and virtue he praises, and to a mysterious and faithless dark lady with whom the poet is reluctantly infatuated. The ensuing triangular situation, resulting from the attraction of the poet's friend to the dark lady, is treated with passionate intensity and psychological insight. Shakespeare's modern reputation is based mainly on the thirty-eight plays which he apparently wrote, modified, or collaborated on. Although generally popular in his day, these plays were often little esteemed by his educated contemporaries, who considered English plays of their own day to be only vulgar entertainment.



William Shakespeare

British Information Services

Shakespeare's professional life in London was marked by a number of financially advantageous arrangements that permitted him to share in the profits of his acting company, the Chamberlain's Men, later called the King's Men, and its two theaters, the Globe (q.v.) and the Blackfriars. His plays were given special presentation at the courts of Elizabeth I and James I (qq.v.) more frequently than those of any contemporary dramatist. It is known that he risked losing royal favor only once, namely in 1599, when his company consented to perform "the play of the deposing and killing of King Richard II" at the instance of a group of conspirators against Queen Elizabeth who were led by her unsuccessful court favorite, Robert Devereux, 2nd Earl of Essex (see under *DEVEREUX*), and by Shakespeare's patron, the earl of Southampton. In the subsequent inquiry, Shakespeare's company was absolved of complicity in the conspiracy. After about 1608 his dramatic production lessened and it seems that he spent more time in Stratford. There he had established his family in an imposing house, called New Place, and became a leading local citizen. He died on April 23, 1616, and lies buried in the Stratford church.

Although the precise date of many of his plays is in doubt, his dramatic career is divided generally into four periods, namely, (1) the period up to 1594; (2) the years from 1594 to 1600; (3) the years from 1600 to 1608; and (4) the period after 1608. In all periods the plots of his plays frequently were drawn from chronicles,

SHAKESPEARE

histories, or earlier fiction, as is the case with the plays of other contemporary dramatists.

First Period. Shakespeare's first period was one of experimentation. His early plays, unlike the late works, sometimes are characterized by wooden and superficial construction and verse. Some of the plays from the first period may be no more than retouchings of earlier works by others.

Four plays dramatizing the English civil strife of the 15th century are possibly his earliest dramatic works. These plays, namely, *Henry VI, Parts I, II, and III* (about 1591–92), and *Richard III* (about 1593), deal with the evil results of weak leadership and of national disunity fostered for selfish ends. The cycle closes with the death of Richard III, a study in satanic malignity, and the ascent to the throne of Henry VII, the righteous founder of the Tudor dynasty, to which Queen Elizabeth I belonged. In style and structure these plays are related partly to earlier medieval drama and partly to the works of earlier Elizabethan dramatists, especially Christopher Marlowe. Either indirectly, through such dramatists, or directly, the influence of the classical Roman dramatist Lucius Annaeus Seneca also is reflected in the organization of these four plays, in the bloodiness of many of their scenes, and in their highly colored, bombastic language. Senecan influence, exerted by way of the earlier English dramatist Thomas Kyd, is obvious particularly in *Titus Andronicus* (about 1594), a tragedy of righteous revenge for heinous and bloody acts which are staged in sensational detail.

Shakespeare's comedies of the first period represent a very wide range. *The Comedy of Errors* (about 1592), an uproarious and farcical imitation of a classical Roman comedy, depends for its appeal on the mistakes in identity among two sets of twins involved in romantic interests and a war. Farce is not so strongly emphasized as comedy of character in *The Taming of the Shrew* (about 1593). *The Two Gentlemen of Verona* (about 1594), a weaker comedy, depends on the appeal of romantic love. In contrast, *Love's Labour's Lost* (about 1594) satirizes the loves of its main male characters, as well as the fashionable devotion to letters by which these noblemen had first sought to avoid romantic and worldly ensnarement. The dialogue in which they voice their pretensions adroitly ridicules the artificially ornate, courtly style deriving largely from the works of the English novelist and dramatist John Lyly.

Second Period. Shakespeare's second period includes his most important plays concerned with English history, his so-called joyous com-

edies, and two major tragedies. In this period his style and approach became highly individualized. The second-period historical plays include *Richard II* (about 1595), *Henry IV, Parts I and II* (about 1597), and *Henry V* (about 1598), that cover the span of history immediately prior to that of the Henry VI plays. *Richard II* is a study of a weak, sensitive, self-dramatizing, but lovable monarch who loses his kingdom to his forcible successor, Henry IV. In the two parts of *Henry IV*, Henry recognizes his own guilt, and his fear for his own son, who later became Henry V, proves unfounded, as the young prince displays an essentially responsible attitude toward the painful duties of kingship. In an alternation of masterful comic and serious scenes, the fat knight Falstaff and the rebel Hotspur reveal contrasting excesses between which the heir apparent finds his reasonable position. The interlarding of the tragic and the comic so as to suggest a broad humanity became one of Shakespeare's favorite devices. *King John* (about 1595), the other historical play of this period, is of less significance.

Outstanding among the comedies of the second period is *A Midsummer Night's Dream* (about 1595). Its fantasy-filled insouciance is achieved by the interweaving of several plots involving two pairs of noble lovers, a group of bumbling and unintentionally comic townsmen, and members of the fairy world, notably Puck, King Oberon, and Queen Titania. Subtle evocation of atmosphere, that characterizes this play, is found also in the tragicomedy *The Merchant of Venice* (about 1596). In the latter play, character is delineated more profoundly than in *A Midsummer Night's Dream*. The Renaissance motifs of masculine friendship and romantic love are portrayed in opposition to the malign inhumanity of a usurer named Shylock, whose own misfortunes are presented so as to arouse understanding and sympathy. The type of quick-witted, warm, and responsive young female, exemplified in this play by Portia, reappears in the joyous comedies of the second period.

The light-hearted comedy *Much Ado About Nothing* (about 1599) is marred, in the opinion of many critics, by an insensitive treatment of its main female character, Beatrice. However, his most mature comedies, *As You Like It* (about 1599) and *Twelfth Night* (about 1600), are characterized by a hilarious and kindly charm depending largely upon the attraction of strong-minded but lovely heroines like Beatrice. In *As You Like It* the contrast between the concepts of the Elizabethan court and those current in

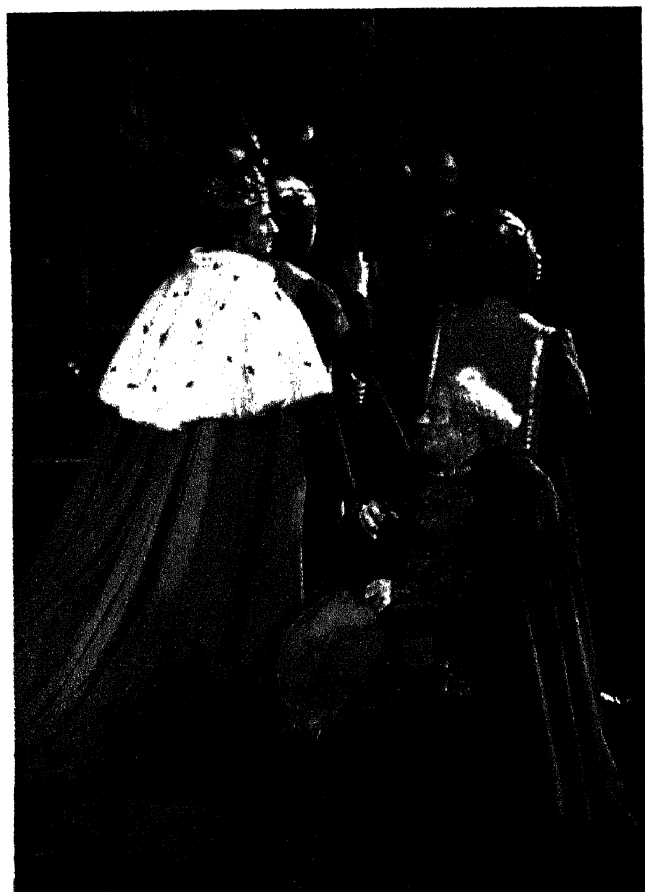


Shakespeare Country. Plate 1. The birthplace of Anne Hathaway, wife of William Shakespeare, at Shottery, near Stratford-on-Avon.

British Tourist Authority

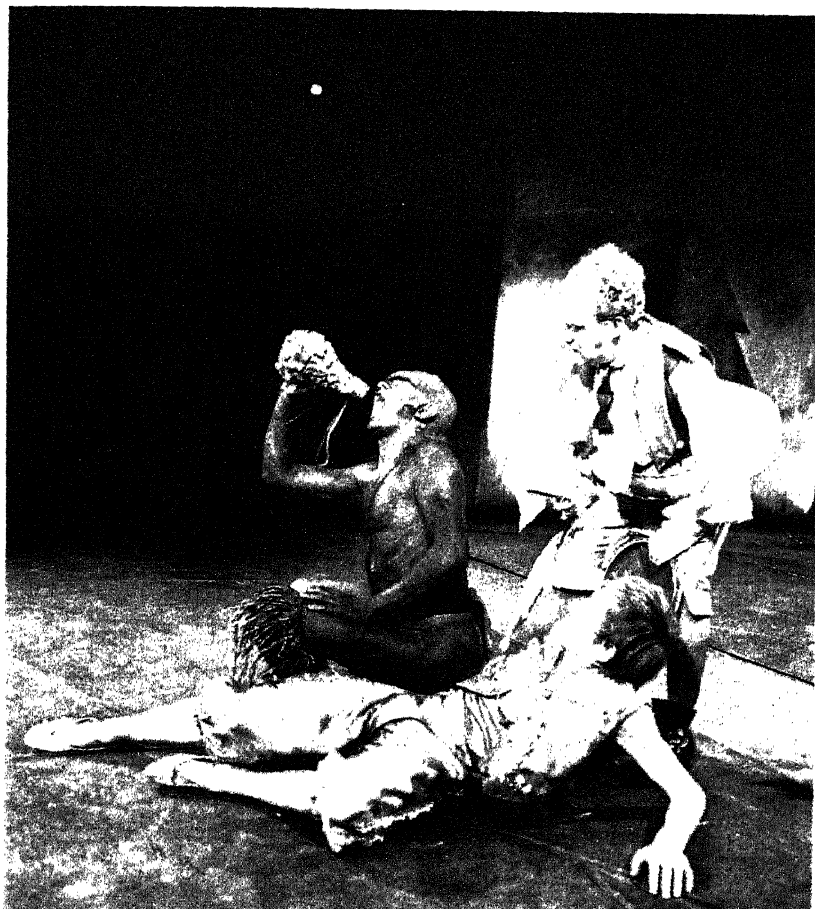


American Shakespeare Festival Theatre, Stratford, Conn.



Shakespeare Plays. Plate 1. Above: A scene from the American Shakespeare Festival Theatre production of *Othello*, with Moses Gunn as the Moor and Lee Richardson as Iago. Left: A scene from the New York Shakespeare Festival production of *Henry IV, Part 2*.

Shakespeare Plays. Plate 2. Right: A scene from the Royal Shakespeare Theatre Company production of *The Tempest*, at Stratford-on-Avon, England. Shown are Roy Dotrice as the slave Caliban, Derek Smith (in white shirt) as Stephano, and David Warner (in gray jacket) as Trinculo. Below: A scene from *Two Gentlemen of Verona*, a musical adaptation of Shakespeare's comedy *The Two Gentlemen of Verona* that was produced on Broadway in 1971, with Jonelle Allen as Silvia and Clifton Davis as Valentine.



British Tourist Authority



George E. Joseph



Shakespeare Country. Plate 2. The Elizabethan Knot Garden, on the site of New Place, in Stratford, the location of the house that Shakespeare bought in 1597 and in which he died in 1616.

British Tourist Authority

the English countryside is presented in a light, charming vein. A complex pattern of oppositions between good and evil characters and between appearance and reality permits Shakespeare to comment in this play on human foibles on many levels. In that respect *As You Like It* is similar to *Twelfth Night*, in which the comical side of the serious emotion of love is illustrated by the misadventures of two pairs of romantic lovers and of a number of realistically conceived or clowning characters in the subplot. Another comedy of the second period is *The Merry Wives of Windsor* (about 1599), a farce of middle-class life in which Falstaff is the comic victim.

Two major tragedies, differing considerably in nature, mark the beginning and the end of the second period. *Romeo and Juliet* (about 1595), famous for its poetic evocation of youthful love, dramatizes the fate of two lovers victimized by the feuds and misunderstandings of their elders and by their own hasty temperaments. On the other hand, *Julius Caesar* (about 1599) is a serious historical tragedy, muted in style.

Third Period. Shakespeare's third period includes his greatest tragedies and his so-called bitter comedies. The tragedies of this period are the most profound of his works and those in which his poetic idiom became an extremely supple dramatic instrument in recording the passage of human thought and the many dimensions of the depicted human situation. *Hamlet* (about 1601), his most famous play, goes far beyond other tragedies of revenge in picturing the mingled sordidness and glory of the human condition. Hamlet feels that he is living in a world of horror; confirmed in this feeling by the murder of his father and the sensuality of his mother, he pursues a pattern of dubious action which is breathlessly compelling. The interpretation of his motivation continues to be the subject of considerable controversy. *Othello* (about 1604) portrays the growth of unjustified jealousy in the protagonist, the Moorish general Othello of Venice. The innocent object of his jealousy is his wife, the lovely Desdemona. In this domestic tragedy, Othello's malignant lieutenant Iago draws him deceitfully into the mistaken jealousy in order to ruin him. *King Lear* (about 1605), conceived on a broader and more epic scale, deals with the consequences of irresponsibility and misjudgment in Lear, a ruler of early Britain, and in his councillor, the duke of Gloucester. The tragic outcome arises as a result of giving power to the evil, rather than to the good, among their offspring. Lear's daughter Cordelia displays a redeeming love which

makes the tragic conclusion a vindication of goodness. The vindication is reinforced by the portrayal of evil as self-defeating, as exemplified by the fates of Cordelia's sisters and of the opportunistic son of Gloucester. *Antony and Cleopatra* (about 1606) is concerned with a different type of love, namely, the middle-aged passion of the Roman general Mark Antony for the opulent Egyptian queen Cleopatra. Their love is glorified by some of the most evocative poetry written by Shakespeare. In *Macbeth* (about 1606) is depicted the tragedy of a great and good man rendered liable to ambition by a defect in his own nature and by the encouragement of others. In getting and retaining the Scottish throne Macbeth progressively dulls his humanity to the point where he becomes a monster capable of any bloody enormity.

Three other plays of this period suggest a bitterness lacking in these great tragedies, because the protagonists do not seem to possess greatness or tragic stature. In *Troilus and Cressida* (about 1602), the most intellectual of Shakespeare's plays, the gulf between the ideal and the real, both individually and politically, is skillfully evoked. In *Coriolanus* (about 1608), another play about classical antiquity, the legendary Roman hero Gaius Marcus Coriolanus is portrayed as unable to bring himself either to woo the Roman masses or to crush them by force. *Timon of Athens* (about 1608) is a similarly bitter play about a character reduced to misanthropy by the ingratitude of his sycophants.

The two comedies of this period also are dark in mood. Of these plays, *All's Well That Ends Well* (about 1602) is less significant than *Measure for Measure* (about 1604), that suggests a picture of the moral life of man in Christian terms more evidently than any other of Shakespeare's plays.

Fourth Period. The fourth period of Shakespeare's work comprises his principal tragicomedies. Toward the end of his career Shakespeare created several plays suggestive of a mood of final reconciliation with the human lot. These plays are written in a grave vein differing considerably from that of his earlier comedies, but ending happily with a reunion or final harmony. The tragicomedies depend for part of their appeal upon the lure of the distant in time or place and all seem more obviously symbolic than most of his earlier works. To many critics the tragicomedies signify a final ripeness in Shakespeare's own outlook, but other authorities believe that the change reflects only a change in fashion in the drama.

The romantic tragicomedy *Pericles, Prince of*

SHAKESPEARE

Tyre (about 1608) concerns the painful loss of a wife by the title character and the persecution of his daughter. After many picturesque and thrilling adventures Pericles is reunited with his loved ones. In *Cymbeline* (about 1610) and *The Winter's Tale* (about 1610) many domestic complications are resolved similarly by restoring each to his own. The most successful product of this particular vein of creativity, however, is what may be Shakespeare's last complete play, *The Tempest* (about 1611), in which the resolution suggests the beneficial effects of the union of wisdom and power. In this play a duke, deprived of his dukedom and banished to an island, confounds his usurping brother by wisely employed magical powers and furthers a love match between his daughter and the usurper's son. Shakespeare's poetic power rarely reached heights as great as it did in this product of his last years.

Two other plays sometimes ascribed to him presumably are the products of a collaboration. A historical drama, *Henry VIII* (1613), probably was written with the English dramatist John Fletcher, as was *The Two Noble Kinsmen* (published 1634), a story of the love of two noble friends for one woman; see BEAUMONT AND FLETCHER.

Literary Reputation. Until the 18th century Shakespeare was thought generally to have been no more than a rough and untutored genius. In the 19th century he was recognized not only as the greatest of English writers but also as the world's greatest dramatist. This opinion, held currently throughout the world, is supported in various ways. His plays communicate a profound knowledge of the wellsprings of human behavior as revealed in his masterful characterizations of a wide gamut of humanity. The skillful use of poetic and dramatic means to create a unified esthetic effect out of a multiplicity of vocal expressions and actions is recognized as an achievement unequaled in other literature. Finally, Shakespeare's employment of poetry within the plays to express the deepest levels of human motivation in relation to man's individual, social, and universal situation is considered one of the most astounding accomplishments of the human intellect.

A somewhat dubious literary theory has been advanced since the 18th century that the English statesman and philosopher Francis Bacon authored the plays commonly attributed to Shakespeare; see BACON-SHAKESPEARE CONTROVERSY.

See also separate articles on individuals whose life dates are not given in this article.

A.K.H.

SHAKESPEARE-BACON CONTROVERSY. See BACON-SHAKESPEARE CONTROVERSY.

SHAKHTY, formerly ALEKSANDROVSK-GRUSHEVSKI, city of the Soviet Union, in the Russian S.F.S.R., about 40 miles N.E. of Rostov. It is the chief commercial center and one of the leading mining centers in the rich anthracite-coal region of the E. Donets Basin. Other industries include the manufacture of iron and steel. The city was founded as a mining town in 1829. Pop. (1970) 205,000.

SHALE, common name applied to fine-grained varieties of sedimentary rock formed by the consolidation of beds of clay or mud; see SEDIMENTARY ROCKS. Most shales exhibit fine laminations that are parallel to the bedding plane, and along which the rock breaks in an irregular, curving fracture. Shales are usually composed of mica and clay (qq.v.) minerals, but the grains are so fine that the rock seems to have a homogeneous appearance, and individual minerals cannot be identified without the aid of a microscope. Most varieties of shale are colored in various shades of gray, but other colors, such as red, pink, green, brown, and black, are often present. Shales are soft enough to be scratched with a knife, and feel smooth and almost greasy to the touch. All gradations in consistency exist between shales and clay; true shales differ from clays in their lack of plasticity in water. Many shales yield oil when distilled by heat, and the sedimentary rocks containing larger quantities of oil are called oil shales. Widely distributed throughout the world, oil shales are a source of oil for countries lacking petroleum. Because petroleum reserves may prove insufficient to satisfy the fast-growing demand for oil, oil shales are an important natural resource. See PETROLEUM: *History; Origin*.

See also GEOLOGY.

SHALER, township of Pennsylvania, in Allegheny Co., on the Allegheny R. and lower Pine Creek, adjoining Pittsburgh on the N. and 6 miles N.E. of the city center. The township includes the villages of Elfinwild, Undercliff, Cherry City, and Mt. Royal, and the manufacturing center of Glenshaw, the name of the post office. Manufactures include auto parts, metal products, electrical goods, bottles, and industrial equipment. Pop. (1960) 24,939; (1970) 33,369.

SHALLOT, culinary vegetable, *Allium ascalonicum*, closely allied to garlic (q.v.), and having similar but less pungent bulbs, which are used in seasoning and for pickles. It is also called scallion, an English derivative of the specific name, derived from Ascalon in Syria, from

where it is said to have been brought by the crusaders in the Middle Ages. See **ONION**.

SHALMANESER, name of several kings of Assyria (q.v.).

SHALOM ALEICHEM or **SHOLOM ALEICHEM** or **SHOLEM ALEICHEM**, pen name of SOLOMON RABINOWITZ or SOLOMON RABINOVICH (1859–1916), Yiddish short-story writer, dramatist, and humorist, born in Pereyaslav (now Pereyaslav-Khmel'nitsky), near Kiev, in the Ukraine, U.S.S.R. His pen name is a traditional Hebrew and Yiddish greeting that means "Peace be with you". At the age of twenty-one he was a teacher in the nearby town of Lubny. From 1890 to 1905 he worked at various occupations in Odessa and Kiev, and then fled from Russia, where the Jews were victims of widespread massacres, to western Europe. At the outbreak of World War I in 1914, he took up permanent residence in New York City. His best-known works were written in Yiddish. The main subject of his writings is the life of simple Russian Jews in small towns. Certain characters recur in his stories, including Menachem Mendel, the typical small-town Jew; the eternal dreamer and schemer (*Luftmensch*); and the best loved of them all, Tobias the Dairyman (Tevye der Milchiger), an indestructible optimist in spite of poverty.

Shalom Aleichem and the Yiddish writer

Shalom Aleichem

Zionist Archives and Library



Shalom J. Abramovich (1836–1917) born in Minsk (now in the White Russian S.S.R.), who used the pen name Mendele Mocher Setorim (1836–1917), generally are regarded as the most creative writers in modern Yiddish literature. Shalom Aleichem's books of short stories include *Stempenyu* and *Yosele Solovei*, published first in the *Yiddishe Folk-Bibliotek* (1889), *Don Kishot mi-Mazepewka* (1892), *Eisenbahn Geschichten* (1909), *Der Blutiger Shpass* (1912–13), and *Der Groisse Gewins* (1916). English translations of Shalom Aleichem's works include *Stempenyu* (1913), *Inside Kasrilevke* (1938), *The Old Country* (1946), and *Tevye's Daughters* (1949). The musical comedy *Fiddler on the Roof* (music, Jerry Bock; lyrics, Sheldon Harnick and book, Joseph Stein), first produced in New York City in 1964, is based on Shalom Aleichem's stories about Tevye. The author is the subject of a work by Maurice Samuel, *The World of Shalom Aleichem* (1943). See **YIDDISH LITERATURE: The Classical Age**.

N.N.G.

SHAMANISM, primitive religion of the Ural-Altaic peoples of northern Europe and northwestern Asia, including the Mongols, Finns (qq.v.), Kirghiz (see **KIRGHIZ SOVIET SOCIAL REPUBLIC**), and Tungus (q.v.); see **URAL-ALTAIC LANGUAGES**. Shamanism is based essentially on the belief that numerous gods and ancestral spirits, both benign and malignant, affect man's fortunes and can be swayed only through the intercession of medicine men, or priestly magicians, called shamans. The power of the shaman to communicate with the gods and spirits is considered supernatural and is supposed to be acquired through heredity (q.v.), the favor of a particular spirit, or instruction by another shaman. The shaman is believed to mediate with supernal and infernal beings by means of incantations, dreams, and visions (see **APPARITIONS**) and to be responsible for augury, the cure of disease, and the orthodox performance of ceremonies. The term "shamanism" is often applied, also, to the religion of peoples not belonging to the Ural-Altaic family, such as the Eskimos (see **ESKIMO**) and some North American Indian tribes; see **AMERICAN INDIANS: Indians of the United States and Canada: Religions and Myths**.

SHAMMAL. See **HILLEL**.

SHAMROCK (Ir. *Seamróg*, "little clover"), any of several trifoliate clovers of the genus *Trifolium* and of related genera, all of which are native to Ireland; see **CLOVER**. The shamrock was originally chosen as the national emblem of Ireland because of the legend that Saint Patrick (q.v.) used the plant to illustrate the doctrine of the Trinity. Most shamrocks, particularly the

SHANGHAI

small-leaved white clover, *T. repens*, have been considered by the Irish as good-luck symbols since earliest times, and this superstition has persisted in modern times among people of many nationalities. Shamrocks or various artificial representations of the plant are worn on St. Patrick's Day, March 17th of each year, particularly in those countries having large population groups of Irish descent, such as the United States and Australia. The hop clover, *T. dubium*, is widely accepted as the original shamrock picked by St. Patrick, but several other clovers are also called shamrock, including the wood sorrel, *Oxalis montana*, and the black medic, *Medicago lupulina*.

SHANGHAI, city and port of the People's Republic of China, in, but independent of, Kiangsu Province, at the confluence of the Whangpoo R. and the Soochow Creek, near the East China Sea, about 150 miles s.e. of Nanking. Shanghai is the largest city of China and is a major commercial and manufacturing center situated in an agricultural region. Its port is the outlet for the Grand Canal system of the Yangtze R. basin. To accommodate ocean-going vessels, the harbor must be constantly dredged. The port district, extending for about 7 mi., handles coastal trade as well as the bulk of foreign shipping of China. Shanghai is a rail junction with connections to

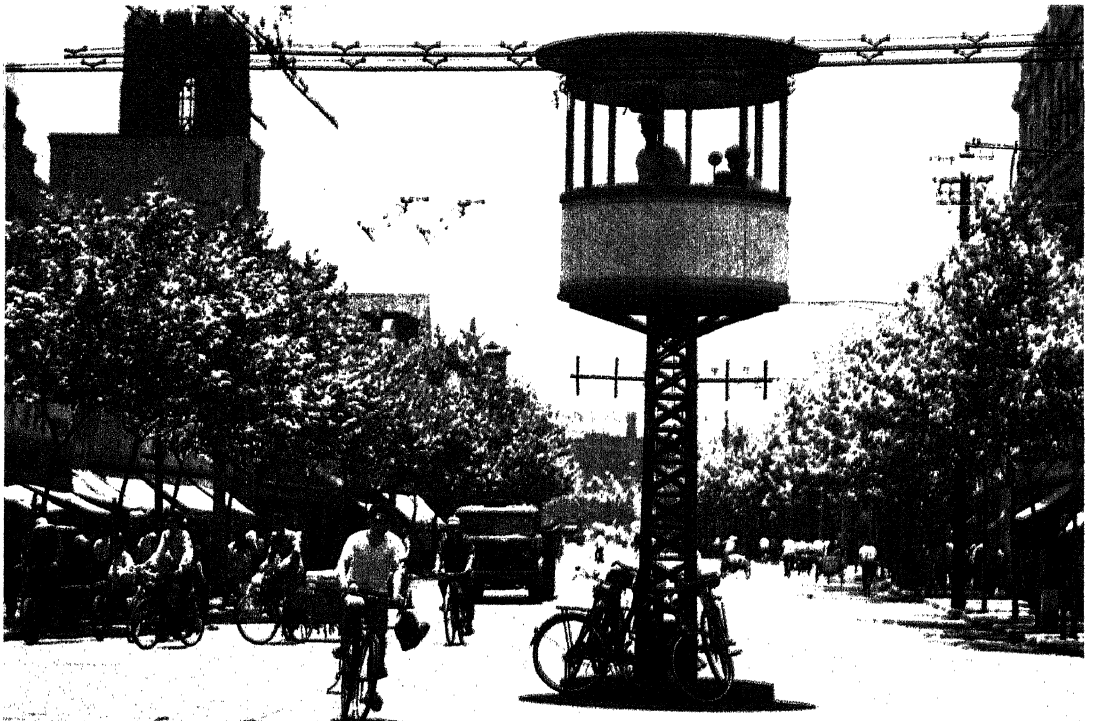
N. and S. China. Textiles and publishing are the major industries. The city also has flour mills, oil refineries, shipbuilding yards, and plants producing cement, chemicals, machinery, paper, processed foods, steel, and tools and dies.

Long an educational center of China, Shanghai has a number of universities as well as technical and scientific institutes. A naval base is located here.

History. Founded in the 11th century, Shanghai did not become important until the 1842 Treaty of Nanking opened the city to foreign trade. This peace treaty, a result of the Opium War with Great Britain, provided for the incorporation of a greater part of the city into the British Concession, in 1843. Subsequently, other nations, including France and the United States, obtained extraterritorial rights and privileges. The British and the U.S. concessions merged in 1863 to form the International Settlement, which was governed by the Shanghai Municipal Council. The foreign zones maintained their own extraterritorial administration, leaving Shanghai a divided city until 1945. With the support of the Chinese Communists, the Nationalist army, led by Chiang Kai-shek (q.v.), captured Shanghai in 1927, and the Chinese section was placed under the Kuomintang government. The Greater Shanghai Municipality was formed in 1928. As a result of a Chinese boycott of its goods, Japan invaded the city in 1932. A truce was declared later that year. The Japanese again

Policemen keep a watchful eye on traffic in Shanghai, China's largest and most populous city.

Jerry Cooke-Photo Researchers



attacked the city in 1937. The British and American troops were evacuated from the International Settlement during 1940 and 1941. Thereafter it was occupied by Japanese troops. Great Britain and the U.S. renounced their claims in Shanghai in 1943, and France renounced its claim in 1946. At the end of World War II, Shanghai was restored to China. During the civil war between the Nationalist government of China and the Communists, Shanghai was captured in 1949 by the Communist forces. During the early 1950's many of Shanghai's factories were moved to the interior. This policy was reversed during the mid-1950's, and Shanghai once again began to thrive as an industrial center. Pop. (1970 U.N. est.) 10,820,000.

SHANGKIU, city of the People's Republic of China, in Honan Province, 80 miles s.e. of Kaifeng. Situated on the Lunghai railroad, it is a market and shipping center for an agricultural area growing grains, vegetables, livestock, and mushrooms. Local industries include silk processing and tanning. The city was the residence of the 11th-century Northern Sung dynasty. The name is also spelled Shang-ch'iu. Pop. (1970 est.) 250,000.

SHANNON, river of the Republic of Ireland, rising at the foot of Cuilcagh Mt. in County Cavan, and flowing about 220 miles s. to the Atlantic Ocean between Loop Head and Kerry Head. The longest river in the British Isles, it forms an estuary about 60 mi. long below Limerick, to which it is navigable by a chain of locks for vessels up to 1000 tons. North from Limerick, the Shannon is navigable for most of its length for small craft. Canals connect the river with the Irish Sea at Dublin. A hydroelectric power station on the river is located at Ardnacrusha, near Limerick.

SHANTY. See CHANTEY.

SHAOHING, or SHAOHSING, city of the People's Republic of China, in Chekiang Province, on a canal near Hangchow Bay, an arm of the East China Sea, 30 miles s.e. of Hangchow. On the Hangchow-Ningpo railroad, it is a trade center for an area growing tea, rice, grains, cotton, and silk. It is noted for its rice wine, woven silk, and paper products. Shaohing has an 11th-century pagoda, 13th-century stone bridges, and a museum commemorating the birthplace of the Chinese writer Lu-Hsün (1881–1936). The city is the site of the capital of the 5th-century B.C. Yüeh kingdom. The name is also spelled Shaoxing. Pop. (1970 est.) 225,000.

SHAOYANG, city of the People's Republic of China, in Hunan Province, on the Tze Shui R., 75 miles n.w. of Hengyang. A road and market cen-

ter, it is a rail-spur terminus on a branch of the Canton-Hankow line. Noted for its bamboo, the area also grows wheat, beans, and timber. Coal and iron deposits are in the vicinity. The name is also spelled Shao-yang; the city was called Paoking until 1926. Pop. (1970 est.) 275,000.

SHAPINSAY. See ORKNEY ISLANDS.

SHAPIRO, Karl Jay (1913–), American poet and critic, born in Baltimore, Md., and educated at Johns Hopkins University. While serving in World War II he wrote *V-Letter and other poems* (1944), which won the Pulitzer Prize for poetry in 1945; also while in military service he wrote *Essay on Rime* (1945), a work in verse on poetic theory. Editor of the magazine *Poetry* from 1950 to 1956, he became professor of English at the University of Nebraska in 1957 and from 1956 to 1963 he also served as editor of the magazine *Prairie Schooner*. In 1967 he joined the faculty of the University of California at Davis. His other writings include *Person, Place, and Thing* (1942), *Poems of a Jew* (1958), and *White-Haired Lover* (1968). He was elected a member of the National Institute of Arts and Letters in 1959 and was awarded the Bollingen Prize in Poetry in 1969 for *Selected Poems* (1968). His novel *Edsel* was published in 1971.

Shapiro is noted for his pungent images and calm, exact observations of his surroundings. His poems frequently deal with the theme of the poet's place in modern society.

SHAPLEY, Harlow (1885–1972), American astronomer, born in Nashville, Mo., and educated at the University of Missouri and Princeton University. He served as astronomer at the Mount Wilson Observatory (q.v.) in California from 1914 to 1921; he was then appointed professor of astronomy and director of the Harvard College Observatory (q.v.) at Harvard University. He retired as director in 1952 and as professor in 1956. Shapley was the first man to prove that the sun is not in the center of the Galaxy (q.v.). He also conducted notable research in the fields of photometry, cosmogony (qq.v.), and spectroscopy (see SPECTRUM), and made investigations of the Cepheid variable stars and of star clusters; see STARS: *Variable Stars*. Throughout his life, he made considerable contributions through his writings to the popularizing of science. He was president of the American Academy of Arts and Sciences from 1939 to 1944, of the American Association for the Advancement of Science in 1947, and of the American Astronomical Society from 1943 to 1946. His books include *Galaxies* (1943; rev. 1967), *Of Stars and Men* (1958), *The View From a Distant Star* (1964), and *Beyond the Observatory* (1967).



The sand shark is a slow-moving fish with long pointed teeth. Most species are not a menace to man.

Photo Researchers

SHARECROPPING. See PEONAGE.

SHARETT, Moshe. See ISRAEL: *History: Independence and War.*

SHARI or CHARI, river of the Central African Republic and the Republic of Chad. It is formed by the Bamingui and Gribingui rivers 105 miles w. of Ndele in the Central African Republic, and flows N.W. for about 500 mi., joining with the Logone R. at Fort Lamy in Chad and entering Lake Chad in a wide delta. It is the chief source of Lake Chad. Navigation for small river steamers is possible only at certain times of year.

SHARK, common name applied to any of the elasmobranchs (see FISH: *Classification*) constituting the order Selachii. Sharks are chiefly marine fishes and are found in all seas, but are especially abundant in tropical and subtropical waters; some species regularly inhabit freshwater. Unlike their close relatives, the rays (see RAY) and chimeras, sharks are fishlike in form and have from 5 to 7 lateral gill clefts. Most of them are of moderate or large size, the largest living sharks attaining a length of over 40 ft.; fossils have been discovered of an extinct species of *Carcharodon* (q.v.) that attained an estimated length of 90 ft. Most sharks are gray in color and

have leathery skin covered with sharp, pointed scales that are known as placoid scales. A shark's mouth is located on the underside of the head, below the anteriorly projecting snout, and is studded with numerous sharp teeth similar in structure to the placoid scales of the skin. The fins are not unusually large; contrary to popular belief, sharks' fins rarely protrude above the surface of the water when the fish are swimming close to the surface. The tail has two lobes; the cartilaginous backbone extends into the upper lobe of the tail. Shark flesh is coarse, but it is edible.

Most sharks are carnivorous, feeding on fishes. A few, such as the basking shark, *Cetorhinus maximus*, and the whale shark, *Rhincodon typus*, feed on plankton, which they strain out of the water with their sievelike gill rakers; see BASKING SHARK; WHALE SHARK. The creatures are active and agile. Contrary to general belief, they do not turn on their backs when they are about to bite. Although some species are known to attack men, most sharks are not man-eaters; the basking shark and the whale shark, that are the largest living sharks, are harmless and do not attack man even when harpooned. Of the man-eating sharks, many are normally timid, attacking only when incited by the smell of blood. One of the dangerous species is a freshwater

gray shark, *Carcharhinus nicaraguensis*, that lives in Lake Nicaragua, Central America, and attains a length of about 8 ft. For descriptions of other important species, see ANGELFISH; DOGFISH; HAMMERHEAD.

Shark liver yields valuable oil containing large quantities of vitamin A; see VITAMIN: *Vitamin Groups: Vitamin A*. The fins are rich in gelatin and are used in the preparation of soup. Other commercial products derived from sharks are a durable leather, made from the hide, and meal and fertilizer, from the carcass. L.P.S.

SHARK SUCKER. See REMORA.

SHARON, city of Pennsylvania, in Mercer Co., on the Shenango R., about 70 miles N.W. of Pittsburgh, in a region noted for the mining of coal and iron. It is an industrial city in which steel products and electrical equipment are manufactured. The Shenango River Reservoir, a flood control project was completed near Sharon in the mid-1960's. Settled in 1795, Sharon was incorporated as a borough in 1841 and as a city in 1918. Pop. (1960) 25,267; (1970) 22,653.

SHARON, plain of W. Israel, lying between the sand dunes of the coast and the foothills of the interior, and extending from ancient Jaffa (present-day Tel Aviv-Jaffa) to ancient Caesarea (present-day Sedot Yam). Now the most densely populated area in Israel, it was noted in Biblical times for its beauty and fertility.

SHARP, William, pen name FIONA MacLEOD (1856?-1905), British poet, novelist, and essayist, born in Paisley, Renfrew, Scotland, and educated at the University of Glasgow. Under his pen name, with which he was not publicly identified until after his death, Sharp wrote a remarkable series of tales and romances in prose and verse based on Celtic folklore (see CELTIC PEOPLES AND LANGUAGES). These include *Pharais* (1894), *The Sin-Eater* (1895), and the play *The Immortal Hour* (1900). He also published works under his own name, including a biography of the British poet Dante Gabriel Rossetti (see under ROSSETTI), and several novels and volumes of verse.

SHASI, city and port of the People's Republic of China, in Hupei Province, on the E. bank of the Yangtze R., 120 miles S.W. of Hankow. It is a major river port and a marketing center for cotton products and salt. The chief industries are textile and flour mills. Pop. (1970 est.) 175,000.

SHASTA DAM, dam in northern California on the upper Sacramento R., a part of the Central Valley Project in that State; see CALIFORNIA: *The Land*. It is 12 mi. north of Redding, Calif. The dam, completed in 1945 and the second highest in the United States, is 602 ft. high and has a

length at its crest of 3460 ft; its 480-ft. spillway makes it the highest overflow dam in the world. Shasta Lake, its reservoir, extends 35 mi. from the dam up the Sacramento, Pit, and McCloud rivers.

SHASTA, MOUNT, peak of California, rising in the Cascade Range in the north-central part of the State. A dormant volcano 14,162 ft. high, it is a scarred cone with lava flows and a snow-capped summit; it is spectacular in its isolation over surrounding mountains. Five glaciers encircle the mountain, the longest of which reaches to the 9500-ft. level. From its western slope rises a secondary peak, about 12,000 ft. high, called Shastina. Although Mt. Shasta has not erupted in modern times, steam vents are still to be seen on its cindered slopes. It was discovered in 1827 by the Canadian fur trader Peter Skene Ogden (1794-1854) and was first climbed in 1854.

SHATT-AL-ARAB. See EUPHRATES.

SHAW, George Bernard (1856-1950), British dramatist, critic, and novelist, born in Dublin, Ireland, and largely self-educated. His father, George Carr Shaw (1814-85), was an unsuccessful businessman; his mother, Lucinda Elizabeth Gurley (1830-1913), was a music teacher. In his youth Shaw enrolled successively in four schools, but he proved to be an indifferent student in most subjects. Music, literature, and painting appealed to him strongly and by incessant reading and visits to art galleries, theaters, and concert halls he acquired a well-rounded education in these subjects before he was fifteen.

Shaw obtained a clerical job in a Dublin real-estate office in 1871. Although he found the work stultifying, he remained with the firm four and a half years. During this period he embarked on his literary career with a letter to the press on the menace of revivalism as practiced by the American evangelists Dwight Lyman Moody (q.v.) and Ira David Sankey (1840-1908); see REVIVALS, RELIGIOUS. Letters to the press were thereafter his favorite means of expression.

Resolved to advance his career as a writer, Shaw went to London in 1876 and lived with his mother, who had moved there earlier. He wrote constantly but realized little income from it. His five novels were all rejected by publishers. Four of the novels, however, were serialized in somewhat obscure magazines between 1884 and 1888.

Socialist Interests. In 1879 Shaw joined the Zetetical Society, a club devoted to discussions of evolution and topics of interest to intellectuals at the time. Although timid at first, he conquered that weakness, became an accomplished



George Bernard Shaw, photographed at his home in Herefordshire, three weeks before his 90th birthday.

UPI

speaker, and developed the "Shavian" wit that later was to characterize his plays. He was interested chiefly in the "conflict between science and religion" until 1882, when a speech by the American economist and social reformer Henry George (q.v.) turned his attention to economics. In the same year he read part of *Capital*, by the German revolutionist Karl Marx (q.v.), and became a socialist. Until 1933 Shaw was a frequent lecturer in behalf of socialism, and socialist ideas were central in much of his writing. He joined the newly founded Fabian Society (q.v.), a socialist club, in 1884, was elected almost immediately to its executive committee, and served in it until 1911. Shaw brought into the Fabian Society his personal friend the British economist, writer, and social reformer Sidney James Webb (see *under* WEBB), who became a

leading socialist writer. Through Webb and his wife Beatrice, also a socialist writer, he met Charlotte Payne-Townshend (1856–1943), an Irish heiress and Fabian, whom he later married. Shaw edited and contributed to *Fabian Essays in Socialism* (1889), an anthology generally considered a classic of socialist literature. His other works in that field include *The Common Sense of Municipal Trading* (1904), an argument for municipal management of business, and *The Intelligent Woman's Guide to Capitalism and Socialism* (1928), a survey of contemporary civilization.

Critical Writings. Shaw first gained a reputation as a music and drama critic. He was art critic for *The World* in 1886–87; music critic for *The Star*, under the pen name "Corno di Bassetto", from 1888 to 1890; music critic for *The World* from 1890 to 1894; and drama critic for *The Saturday Review* from 1895 to 1898. As a music critic, he championed the German composer Richard Wagner; as a drama critic, he crusaded for the Norwegian playwright Henrik Ibsen and attacked the Shakespearean productions of the British actor and theatrical manager Sir Henry Irving (qq.v.). In his letters to the British actress Dame Ellen Alice Terry (q.v.), Shaw attempted to win her support for the new theater of ideas. His criticisms have been collected in nine volumes, the best known of which are *The Quintessence of Ibsenism* (1891), *The Sanity of Art* (1895), *The Perfect Wagnerite* (1898), and *Dramatic Opinions and Essays* (1907). In addition he expressed his critical ideas in the prefaces to his plays.

Plays. Shaw's fame rests upon his work as a dramatist. His more than fifty plays have been produced throughout the English-speaking world and translated into all major languages. They were frequently produced in London only some years after he wrote them, as is indicated by the dates given below.

Shaw called three of his early plays "unpleasant", thereby indicating that he knew his drama of ideas and the ideas themselves were not palatable fare for conservative London audiences. The "unpleasant" plays are *Widowers' Houses* (written and produced in 1892), which depicts the clash between ideals and realities among owners of slum real estate; *Mrs. Warren's Profession* (1893; produced, 1902), a drama about prostitution taken as a typical capitalist enterprise; and *The Philanderer* (1893; produced, 1907).

In an equally frank attempt to be popular, Shaw next turned out a series of "pleasant plays". The first, *Arms and the Man* (produced

in 1894), a satire on romantic militarism, brought him financial independence and international recognition as a dramatist. Others in the "pleasant" series include *Candida* (1894; produced, 1900), which is about a self-assured woman, a romantic poet, and a socialist clergyman; and *You Never Can Tell* (1896; produced, 1899). They were all published in a two-volume collection, with characteristic prefaces by Shaw, called *Plays, Pleasant and Unpleasant* (1898). *The Devil's Disciple* (1897; produced, 1899); *Caesar and Cleopatra* (1899; produced, 1907), in which he presents Caesar as a soldier and statesman of great sagacity but vain and somewhat boyish in private life; and *Captain Brassbound's Conversion* (produced in 1900), were all published as *Three Plays for Puritans* (1901). In *Man and Superman* (1901–03), especially in the notable scene known as "Don Juan in Hell", Shaw expounds an optimistic faith in creative evolution (see BERGSON, HENRI) and the so-called life force, as well as in man's ability to create a better world by willing it and working for it. Produced without the "Don Juan" sequence in 1905, it was not produced in full until 1925. He deals in *Major Barbara* (written and produced in 1905) with the problem of wealth and poverty by depicting the disillusionment of a young major in the Salvation Army.

Shaw wrote his greatest plays during the next decade. In *Heartbreak House* (1919; produced, 1921), set in an English country-house environment of the early-20th century, he treats aspects of life of that period that reflect the underlying causes of later undesirable moral and political conditions. Other outstanding works of this period are *Pygmalion* (1912; produced, 1914), *Androcles and the Lion* (produced in 1913), and the pentalogy *Back to Methuselah* (1921; produced, 1924). In *Saint Joan* (1923; produced, 1924), he shows the nonconforming saint or, as defined in the preface, the "genius" victimized by the forces of church and state.

Shaw was awarded the 1925 Nobel Prize in literature. In his last plays the recurrent theme is politics or international relations; of these the best known are probably *The Apple Cart* (1929), *Geneva* (1938), and *In Good King Charles's Golden Days* (1939; produced, 1940).

Arms and the Man was the basis of the operetta *The Chocolate Soldier* (1908) by the Austrian composer Oscar Straus (1870–1954). *Pygmalion*, one of the few Shaw plays to be filmed (1938), was also the basis for the successful musical comedy *My Fair Lady* (1956), with book by Alan Jay Lerner and music by Frederick Loewe (qq.v.).

Evaluation. Shaw found the British theater devoted to sentimental comedy and sensational melodrama; he made it a vehicle for the expression of contemporary thought. His vigorous style, enhanced by his musical and oratorical background and his love of fine workmanship, is a model for all who wish to treat serious matters in the drama without solemnity. His power to create original dialogue and striking characterization in colorful situations is especially notable. In addition to their philosophical concerns many of his plays contain scenes of deep feeling. His unique Shavian style expressed, in the main, irreverence for tradition, maddening self-assurance, satiric humor, contempt for current morality, championship of the unpopular and persecuted, and amazing vitality. Although his style and artistic method have not profoundly affected the British and American theater, he is the only dramatist of the past century who can be compared to William Shakespeare (q.v.) as the spokesman of an era.

SHAW, Henry Wheeler. See BILLINGS, JOSH.

SHAW, Irwin (1913–), American novelist, short-story writer, and playwright, born in New York City, and educated at Brooklyn College. He served in the United States Army in Europe during World War II and later wrote for the army newspaper *Stars and Stripes*. He first won recognition as a playwright for *Bury the Dead* (1936) and *The Gentle People* (1939), but his greatest success was his novel about World War II, *The Young Lions* (1948). The novel traced the destinies, fated to cross, of individual soldiers on both sides in the war, and it demonstrated Shaw's talent with realistic dialogue and his feeling for the common man. His other novels include *The Troubled Air* (1950), *Two Weeks in Another Town* (1959), *Voices of a Summer Day* (1965), and *Evening in Byzantium* (1973). He also produced a number of short stories, which were published in *Act of Faith* (1946), *Tip on a Dead Jockey* (1957), *Love on a Dark Street* (1965), and other collections.

SHAWINIGAN, city of Canada, in Québec Province, in Saint Maurice Co., on the Saint Maurice R., about 17 miles n.w. of Trois-Rivières. It is an important industrial center; the chief manufactures are textiles, paper, chemicals, and aluminum. Until 1958 the city was named Shawinigan Falls, after the nearby falls, 165 ft. high, which are a major source of hydroelectric power. Settled in 1899, it was incorporated as a city in 1921. Pop. (1976) 24,921.

SHAWN, Ted, in full EDWIN MYERS SHAWN (1891–1972), American dancer and choreographer, born in Kansas City, Mo., and educated at

SHAWNEE

the University of Denver. He made his first appearance as a dancer in Los Angeles, Calif., in 1912. In 1914 he married the American dancer Ruth St. Denis (q.v.) and in the next year they founded the first of their Denishawn schools in Los Angeles. The schools, designed to develop a distinctly American dance form, featured variations of many dancing styles. The stress on individuality and experimentation with new forms of dance inspired a number of students to form their own modern dance companies; among them was the American dancer Martha Graham (q.v.). The Denishawn company, organized at the same time as the school, toured Europe, the Orient, and America in the 1920's and 1930's.

In 1933 Shawn founded the first company composed entirely of male dancers, with headquarters at Jacob's Pillow, a former farm near Lee, Mass. Although the company was disbanded in 1940, Shawn continued to teach each summer at his University of the Dance at Jacob's Pillow. In 1941 he established the Jacob's Pillow Dance Festival, which each summer presents new and established dance groups from all over the world. See *DANCE: Professional Dance in Western Civilization: Modern Dance*.

SHAWNEE, North American Indian tribe of the Algonquian (q.v.) linguistic stock, formerly settled mainly in present-day South Carolina and Tennessee. In the late 17th century they were driven northward into present-day Ohio by the Cherokee (q.v.) Indians. During the 18th century the Shawnee fought against the American settlers, but in the early 19th century sold their lands and moved to Missouri and Kansas. Most later settled in Indian Territory (now part of Oklahoma), where about 1000 Shawnee live today.

SHAWNEE, city in Oklahoma, and county seat of Pottawatomie Co., on the North Canadian R., 42 miles s.e. of Oklahoma City. The city is the commercial center of an extensive agricultural area, and the headquarters and supply center of large oil and natural-gas fields. Among the industrial establishments in Shawnee are meat-packing and food-processing plants, canneries, and factories producing clothing and electrical motors. Shawnee is the site of Oklahoma Baptist University (1910), and Saint Gregory's College (1875), a Roman Catholic junior college noted for its art gallery and museum. Shawnee was founded in 1891 and incorporated as a city in 1894. Pop. (1960) 24,326; (1970) 25,075.

SHAWNEE PROPHET or **TENSKWATAWA**. See **TECUMSEH**; **TIPPECANOE**, **BATTLE OF**.

SHAYS' REBELLION, uprising in Massachusetts in 1786–87 caused mainly by excessive land

taxation, high legal costs, and economic depression following the American Revolution (q.v.). The insurgents, who were mainly poor farmers threatened with loss of their property and imprisonment for debt, were headed by Daniel Shays (1747?–1825), a former captain in the American revolutionary army. They demanded protective legislation, the abolition of the court of common pleas, and a radical reduction of taxes. In 1786, armed mobs prevented the sitting of the courts at Northampton, Worcester, Great Barrington, and Concord; and Shays, with 800 followers, broke up a session of the State supreme court in Springfield. On Jan. 25, 1787, Shays and his men marched into Springfield to seize the Federal arsenal, but they were repulsed by a force of militia under American general William Shepard (1737–1817). The rebels fled toward Petersham, where they were finally defeated. Most of the men were pardoned later in the year; Shays, condemned to death, escaped to Vermont and was pardoned a year later.

SHCHERBAKOV. See **RYBINSK**.

SHEARWATER, or **HAGDON**, petrel of the genus *Puffinus*, differing from other petrels in having the nostrils opening separately and divided by a very thick partition. Shearwaters spend their lives mostly on the ocean, skimming the waters with very rapid flight and plunging into them for their food. They rarely visit the shore except for the purpose of incubation. All are sooty brown or grayish above and white below with various specific markings. The greater shearwater, *P. gravis*, about 20 in. long, wanders over the whole Atlantic Ocean and is abundant on the coasts of Newfoundland. Shearwaters breed on islets, in rabbit burrows, or in crevices of the rocks and lay one or two white eggs. Sixteen other species are found in various parts of the world. One of these species *P. tenuirostris*, is well known about Australia as mutton bird. See **PETREL**.

SHEBA or **SABA**, ancient kingdom of southwestern Arabia (now the Yemen Arab Republic) mentioned in the Bible, most notably in the story about the meeting between the Hebrew king Solomon (q.v.) and the queen of Sheba (1 Kings 10:1–13).

The inhabitants of Sheba, the Sabaeans, spoke a language in the Arabic group of the southern branch of the Semitic languages (q.v.). The kingdom probably originated about the 10th century B.C., and it was one of the most powerful kingdoms in southern Arabia until about 115 B.C., when the Himyarites (q.v.) gained ascendancy. Its capital and chief city (7th cent.–2nd cent.

B.C.) occupied the site of present-day Márib, 75 miles E. of San'a, the capital of Yemen Arab Republic (q.v.). At the height of its development, in the 8th century B.C., the kingdom maintained colonies along trade routes leading to Palestine, and Márib was one of the wealthiest cities of ancient Arabia. See ARABIA: *History*; ETHIOPIA: *History*.

SHEBOYGAN, city and port of entry in Wisconsin, and county seat of Sheboygan Co., on Lake Michigan at the mouth of the Sheboygan R., about 55 miles N. of Milwaukee. Sheboygan is an important shipping center for the Great Lakes (q.v.); the harbor is open year-round. The city is a noted cheese-shipping port and fishing center. It also has foundries, tanneries, and factories manufacturing plumbing and heating equipment, enamelware, machinery, furniture, textiles, and leather and paper goods. Mineral water is bottled and shipped from Sheboygan. The site of the city was first occupied by a trading post in 1820, and in 1846 the settlement was incorporated as a village. Sheboygan was chartered as a city in 1853. Pop. (1960) 45,747; (1970) 48,484.

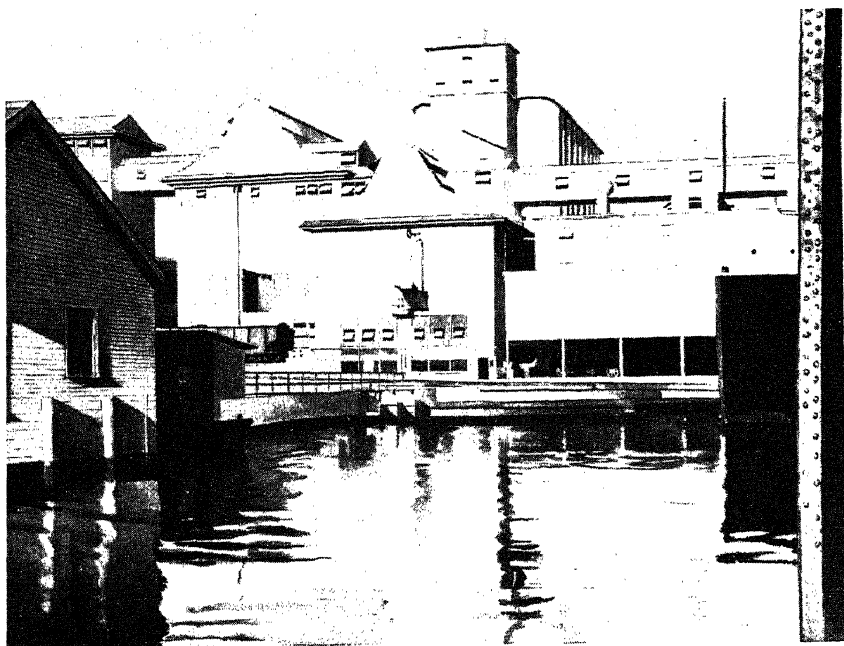
SHEELER, Charles (1883–1965), American painter and photographer, born in Philadelphia, Pa., and educated at the School of Industrial Art in Philadelphia and at the Pennsylvania Academy of the Fine Arts. During a visit to Paris in 1909, he was profoundly influenced by the work of the French painters Georges Braque and Henri Matisse and the Spanish painter Pablo Pi-

casso (qq.v.). The postimpressionist influence (see POSTIMPRESSIONISM) dominated his paintings for a period, but he ultimately developed a highly personal style combining the naturalistic and the abstract. Industrial scenes, in which he patterned the forms of machinery into abstract shapes, became his favorite subjects. Sheeler made photography his chief vocation from 1912 to 1931. His work in this field closely resembles his paintings in subject matter and treatment. Some of his best-known paintings are "Upper Deck" (1929, Fogg Art Museum, Cambridge, Mass.), "American Landscape, 1930" (Museum of Modern Art, New York City); and "Midwest, 1954" (Walker Art Center, Minneapolis, Minn.).

SHEEN, Fulton J(ohn) (1895–), American Roman Catholic prelate, educator, and author, born in El Paso, Ill., and educated at Saint Viator College, Kankakee, Ill.; Saint Paul Seminary, Saint Paul, Minn.; the Catholic University of America, Washington, D.C.; and the University of Louvain, Belgium. He was ordained a priest in 1919 and in 1926 became a member of the faculty of the Catholic University of America, later rising to the position of assistant professor. From 1930 to 1945 he was a preacher on "The Catholic Hour", a widely known radio program, and from 1931 to 1945 he preached the Lenten course of sermons (see LENT) at Saint Patrick's Cathedral (q.v.) in New York City. Sheen was appointed domestic prelate in 1935, with the title right reverend monsignor. In 1951 he was made auxiliary bishop of New York City. Trans-

"River Rouge Plant", a painting (1932) by Charles Sheeler.

Whitney Museum of American Art



SHEEP

ferred to the episcopal see of Rochester, N.Y., he was installed there as bishop on Dec. 15, 1966; he resigned in 1969.

Beginning in 1952, he appeared for some years on his own television program, "Life Is Worth Living". Bishop Sheen's books include *God and Intelligence* (1925), *Tactics of Communism* (1937), *Peace of Soul* (1949), *Life Is Worth Living* (5 vol., 1953-58), *Way to Inner Peace* (1955), and *Life of Christ* (1958).

SHEEP, common name for any of eight quadruped ruminants of the genera *Ovis*, *Pseudois*, and *Ammotragus*, which, with the goats, form the subfamily Caprinae of the family Bovidae (q.v.); see also ARTIODACTYLA; GOAT. Wild sheep are native to mountainous regions or to elevated tablelands. The mountains and plateaus of central Asia are the home of several notable species. The Marco Polo sheep, or argali (q.v.),

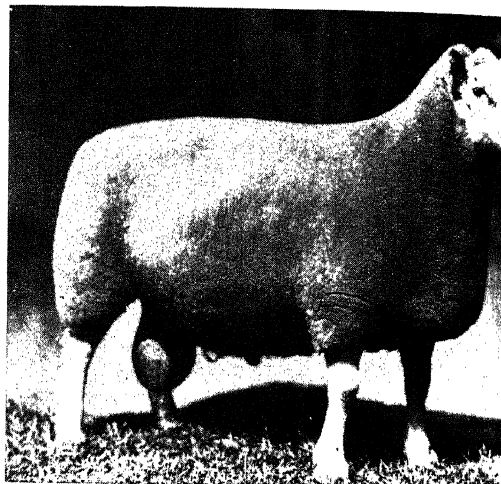
Breeds of sheep. Below, left: Karakul ram. Below, right: Cheviot ram. Bottom, left: Columbia ram. Bottom, right: Hampshire Downs ram lambs.

O. ammon, stands about 50 in. high at the shoulder, and is unique in that the horns form an open spiral, with the tips pointing outward, instead of curving in essentially the same plane. The aoudad (q.v.), *A. lervia*, of North Africa and the bighorn (q.v.), *O. canadensis*, of North America are about the same size as the Siberian species, and the European mouflon, *O. musimon*, of the mountains in Greece and the Mediterranean islands, is considerably smaller. Most wild sheep have a coat of short wool and long, straight hair. The hair has been lost in the domestic breeds, and selective breeding has increased the length and abundance of wool.

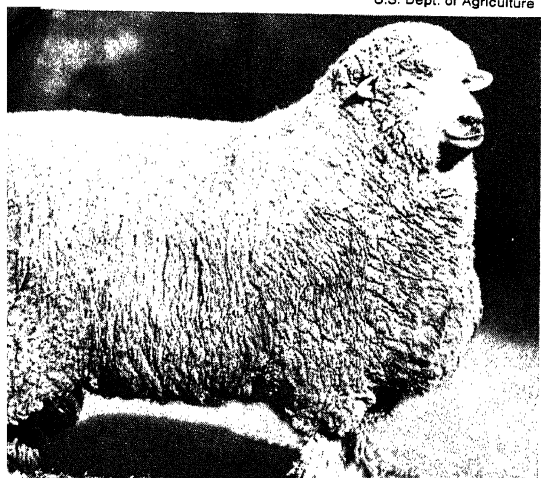
The common sheep, *O. aries*, was domesticated by man in Asia and Europe before recorded history and introduced into the Western Hemisphere during the explorations following the discoveries of the Italian navigator Christopher Columbus (q.v.). The common sheep is raised principally for its wool (q.v.) and its flesh; the skin is used for fine leather (q.v.). In moun-



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tainous parts of India and in Tibet, the sheep is used as a beast of burden.

Sheep raising, both as a branch of agriculture and as a separate practice of animal husbandry, is common throughout the world, but especially in the temperate climates. Until the 19th century, the nations of western Europe were foremost in sheep raising, but since that time Australia, the United States, the U.S.S.R., the Republic of South Africa, India, and Argentina have been the principal sheep-producing countries.

Types of Sheep. More than 200 breeds of sheep have been developed, and of these only about thirty are universally known. The Merino and the Rambouillet are fine wool breeds; Karakul and Romanov are fur types; the Blackhead Persian, native to northeastern Africa and Asia Minor, is raised principally in South Africa for mutton, thriving on land not suited for woolly sheep. Other breeds, raised chiefly for their milk, but producing wool of high or medium quality, include the East Friesian of West Germany; La Razza Sarda of Sardinia; the Pelvin and Sevlievo of Bulgaria; and the Svishtov of the Danube basin.

The Merino sheep, which originated in Spain, is the most important breed of sheep in countries of the Northern Hemisphere. Various strains of this breed have been named according to the country of origin, but all strains have heavy fleece of white wool, which is sufficiently lubricated with lanolin to keep the inner wool soft and pliable. Merino sheep were introduced into the United States in 1801 by the agriculturist Seth Adams, and by 1812 the breed had been imported in large numbers and had been scattered throughout New England and as far west as Ohio. For many years the Spanish Merino was the most popular breed of sheep in America, and sheep breeding became an important industry even on small farms. The original strain was gradually improved by selective breeding; the wool was lengthened, and the quality of the meat was improved. The resultant strain is known as the American Merino.

The Rambouillet is a French breed, developed from the Spanish Merino toward the end of the 18th century. It produces a fine wool and superior mutton. It was introduced into the U.S. about 1840 and quickly became popular, especially in the western States.

English breeds, producing excellent mutton and medium-grade wool, were introduced into the U.S. after the Merino. When wool demand decreased and the requirements for meat increased, mutton-producing breeds with fair

wool production became more popular. Early spring lambs, that is, lambs born and fattened in barns during the winter, are produced by such breeds as the English Dorset and the French Île de France. Early-maturing lambs and high grades of wool are produced by the Columbia breed, developed by the United States Department of Agriculture; by the Oldenburg, developed in Germany; and by the Panama and Romeldale, developed in Idaho and California, respectively. Highest-grade mutton and wool are produced by the Hampshire, Shropshire, and English Leicester breeds. Strains that produce good mutton but indifferent wool include the Welsh Mountain, Oxford, Suffolk, Southdown, and Border Leicester; those that produce good wool and poor mutton are the Cheviot, of England, and the Texcel, of the Netherlands. The Scottish Blackface or Black-faced Highland is a hardy breed that gives good meat, and the wool is used principally in Scottish tweeds.

The number of sheep on American farms and ranges reached a peak of 56,000,000 in 1942. In the early 1970's the number of sheep on U.S. farms averaged about 22,000,000. R.R.St.

SHEEP DOG or SHEPHERD DOG, any of several breeds of dogs used to tend sheep. Among the duties of the sheep dog are driving sheep to pasture and guarding them in both the field and fold. The breed is sometimes also employed in tending cattle. The principal varieties of sheep dog are the collie, German shepherd dog, old English sheep dog, Schipperke, Belgian sheep dog (qq.v.), and Shetland sheep dog.

SHEEPSHEAD, American fish of the porgy family, Sparidae, allied to the perches. It occurs along the east coast from southern Florida to Cape Cod. The name refers to the shape and color of the head, and to the teeth, which are broad blades in front and grinding molars on the sides of the jaws. Sheepshead live near the bottom, near oyster and mussel beds or sunken wrecks, feeding on mollusks and barnacles.

SHEFFIELD, city of Alabama, in Colbert Co., on the Tennessee R., about 100 miles N.W. of Birmingham. A railroad center in an iron and coal region, the city manufactures iron and steel products, aluminum, and chemicals. Cotton is the chief crop. Rich in hydroelectric power, Sheffield is a center for the Tennessee Valley Authority (q.v.). Nearby are Wilson and Wheeler dams. A national forest and a State park are in the area. Founded in 1883, Sheffield was incorporated in 1887. Pop. (1960) 13,491; (1970) 13,115.

SHEFFIELD, Great Britain, county borough, of West Riding, Yorkshire, England, at the junction

SHEFFIELD

of the Don R. and its tributaries, the Sheaf, Rivelin, and Loxley rivers, about 158 miles n.w. of London.

Sheffield is famous for the manufacture of steel and steel products, notably cutlery. By the 14th century the region was already known for its production of cutlery. Waterpower, furnished by the Don and its tributaries, and the iron ore found in the region were prime reasons for the growth of Sheffield as an industrial center. In 1740 the British inventor Benjamin Huntsman (1704–76), a local clockmaker, discovered the process of manufacturing cast steel that would possess a predictable quality of tensility and toughness. In the following century the British inventor Sir Henry Bessemer (q.v.) developed in Sheffield a method of manufacturing cast steel that revolutionized the industry; see **IRON AND STEEL MANUFACTURE: History**. Manganese steel was introduced in 1882, and in 1914 the process of making stainless steel was discovered in Sheffield. In 1935 malleable steel was developed there. Cutlery manufactured in Sheffield includes almost every type of tool and instrument. Other steel products include rails and railway fittings, stoves, armor plate, engine castings, and hydraulic presses. Since 1742 Sheffield has been famous for the manufacture of Sheffield plate, articles of copper coated with silver; see **SILVERWARE: Silver Plate**. Industries also include the manufacture of glass, snuff, candy, canned goods, bicycles, chemicals, paper, phonographs and phonograph needles, brushes, paints and varnishes, cooking utensils, and bookbinding, and iron and brass founding.

The city has many fine buildings, among them the parish church, erected during the reign of the English king Henry I (q.v.); Saint Mary's Catholic Church, surmounted by a tower 200 ft. high; and since 1913, the Cathedral of Saint Peter and Paul, originally built during the 14th and 15th centuries. The city is the seat of the University of Sheffield, founded in 1905.

History. The Manor of Hallam, near the site of the city, existed at the time of the Norman Conquest. Mary Queen of Scots, (q.v.), spent fourteen years (1570–84) of her captivity in the town's castle. During the Great Rebellion (q.v.), Sheffield was seized by the Parliamentarians, abandoned to the Royalists under the English statesman William Cavendish, later duke of Newcastle (see *under* **NEWCASTLE**), recaptured, and the castle demolished. Sheffield was incorporated as a city in 1893. During World War II the city was heavily bombed by the Germans; approximately 33,000 houses were damaged and many were destroyed. Pop. (1971) 519,703.

SHEHAN, Lawrence (Joseph), Cardinal (1898–), American Roman Catholic ecclesiastic, born in Baltimore, Md. He studied at Saint Charles College, Saint Mary Seminary, and the North American College in Rome, Italy. Following ordination as a priest in 1922, he served as curate and then pastor of Saint Patrick Church in Washington, D.C., until 1945, when he was consecrated auxiliary bishop in the archdiocese of Baltimore and became pastor of Saints Philip and James Church in that city. In 1953 he was appointed bishop of the newly constituted diocese of Bridgeport, Conn. Cardinal Shehan became archbishop of Baltimore in 1961. In 1965 he was elevated to the cardinalate by Pope Paul VI (see *under* **PAUL**). One of the earliest supporters of ecumenism, he has also been active in promoting civil-rights causes, especially programs aimed at eliminating racial discrimination. He is a member of the Sacred Congregation for the Doctrine of the Faith and the Sacred Congregation for Bishops. He is president of the Permanent Committee for International Eucharistic Congresses, and was one of the four United States delegates to the first Synod of Bishops, held at the Vatican in Rome in 1967.

SHELBURNE, 2nd Earl of, Sir William Petty. See *under* **LANSDOWNE**.

SHELBY, city in North Carolina, and county seat of Cleveland Co., about 20 miles w. of Gastonia. Situated in an agricultural area where cotton is grown, the city processes foods and manufactures textiles. It is a market center for dairy and poultry. Pop. (1960) 17,698; (1970) 16,328.

SHELBYVILLE, city in Indiana, and county seat of Shelby Co., about 27 miles s.e. of Indianapolis. A trade center for the surrounding livestock, dairy, and grain area, the city is located in a rich corn belt. Manufactures include paper products, heating equipment, and clothing. Founded in 1822, Shelbyville was incorporated in 1860. Pop. (1960) 14,317; (1970) 15,094.

SHELBYVILLE, town in Tennessee, and county seat of Bedford Co., on the Duck R., about 49 miles s.e. of Nashville. The town is located in a farm and lumber area. Manufactures include clothing, paper, and electrical products. Shelbyville is noted for its breeding of the Tennessee Walking Horse; see **HORSE: Modern Horses: Breeds**. Settled in 1810, the town was incorporated in 1819. Pop. (1960) 10,466; (1970) 12,262.

SHELL or SEASHELL, hard, largely calcareous skeleton of marine animals, especially the mollusks; see **MOLLUSCA: Shells**.

SHELL, in loose military usage, a bomb or a projectile fired from a mortar (qq.v.), recoilless

rifle, launcher, or a cannon-type weapon. See ARTILLERY; CANNON; RIFLE.

SHELLAC, natural resin secreted by a scale insect, *Laccifera lacca*, which lives on the twigs of certain trees native to India and Indonesia. The resin is collected, dried, and purified to make the various grades. It is used in varnishes, coatings, and as a binder; see VARNISH. See also LACQUER; RESINS.

SHELLEY, name of two British writers who were husband and wife.

Percy Bysshe Shelley (1792–1822), poet, born at Field Place, near Horsham, Sussex, England, and educated at Eton College and, until his expulsion at the end of one year, University College, University of Oxford. With another student, Thomas Jefferson Hogg (1792–1862), Shelley had written and circulated a pamphlet, *The Necessity of Atheism* (1811), of which the university authorities disapproved. He had also previously published a pamphlet of burlesque verse, *Posthumous Fragments of Margaret Nicholson* (1810).

Shortly after his expulsion, the nineteen-year-old Shelley married his first wife, Harriet Westbrook (1796–1816). Two years later he published his first long serious work, *Queen Mab: A Philosophical Poem* (1813). The poem was one result of Shelley's friendship with the British philosopher William Godwin (see *under* GODWIN), expressing Godwin's freethinking Socialist philosophy. Another result of their friendship was Shelley's relationship with Godwin's daughter Mary Wollstonecraft Godwin. In 1814, after separating from his wife, Shelley toured the continent of Europe briefly with Mary.

Returning to England he produced the verse allegory *Alastor, or The Spirit of Solitude* (1816), which gave more of a foretaste of his later important work. During another brief visit to the continent in the summer of 1816, Shelley and Mary met the British poet George Gordon Byron (q.v.). At this time Shelley wrote two short poems, "Hymn to Intellectual Beauty" and "Mont Blanc". In December, 1816, three weeks after the body of Harriet Westbrook Shelley, an apparent suicide, was recovered from a lake in a London park, Shelley and Mary were married.

In 1817 Shelley produced *Laon and Cynthia*. A long narrative poem telling a symbolic tale of revolution within and without the human mind, it was later reissued as *The Revolt of Islam* (1818). At this time he also wrote revolutionary political tracts signed "The Hermit of Marlow". Early in 1818 he and Mary left England for the last time.

During the remaining four years of his life

Shelley produced all of his major works. Traveling and living in various Italian cities, the Shelleys were associated with the British poet Leigh Hunt (q.v.) and his family, as well as Lord Byron. Shortly before his thirtieth birthday, Shelley was drowned in a storm while attempting to sail from Leghorn to La Spezia. Ten days later his body was washed ashore.

Many critics regard Shelley as one of the greatest of all English poets. They point espe-



Percy Bysshe Shelley

cially to his lyrics, including the familiar short odes "To a Skylark" (1820), "To the West Wind" (1819), and "The Cloud" (1820). Also greatly admired are the shorter love lyrics, including "I arise from dreams of thee" and "To Constantia singing"; the sonnet "Ozymandias" (1818); and "Adonais" (1821), an elegy for the British poet John Keats (q.v.), written in formal Spenserian stanzas. The effortless lyricism of these works is also evident in Shelley's verse dramas, *The Cenci* (1819) and *Prometheus Unbound* (1820); these remain, however, profound but unproduceable closet dramas. His prose, including a translation (1818) of *The Symposium* by the Greek philosopher Plato (q.v.) and the unfinished critical work *In Defence of Poetry* (1822), is equally skillful. Other critics, particularly those anti-Romanticists who find the prettiness and sentimentality of much of his work less

SHELLFISH

than inspired, are quick to point out that Shelley was not as influential as the other British Romantic poets Byron, Keats, or William Wordsworth (q.v.) See also ROMANTICISM: *Literature*.

Mary Wollstonecraft Shelley (1797–1851), novelist, daughter of the British philosopher William Godwin and the British author and feminist Mary Wollstonecraft Godwin, born in London, England, and privately educated. She met Percy Bysshe Shelley in May, 1814, and two months later left England with him. When Shelley's first wife died in December, 1816, he married Mary. In 1818 her first and most important work, the novel *Frankenstein*, was published. A remarkable accomplishment for a twenty-year-old girl, the work was an immediate critical and popular success. Repeatedly dramatized for both the theater and motion pictures, this tale of "Doctor" Frankenstein and the subhuman monster he assembles from parts of human corpses added a new word to the English language: a Frankenstein is any creation that ultimately destroys its creator. No other work by Mrs. Shelley achieved the popularity or excellence of this first work, although she wrote four other novels, books of travel sketches, and miscellaneous tales and verse. One of her novels, *The Last Man* (1826), reveals her liberal social outlook; another, *Lodore* (1835), is a novelized autobiography.

SHELLFISH, popular term for many aquatic animals not fishes in the sense in which the word fish is usually understood; these include oysters, clams and all mollusks, and crustaceans such as crabs and lobsters. See CRUSTACEA; MOLLUSCA.

SHELTERBELT, wind barrier comprising trees and shrubs, employed as a means of protection for crops and for the prevention of soil erosion; see CONSERVATION: *Soil Conservation*; EROSION: *Soil Erosion*; SOILS AND SOIL MANAGEMENT.

SHELTON, city of Connecticut, in Fairfield Co., on the Housatonic R., about 8 miles N. of Milford. The city manufactures machinery, metal products, tools, silverware, textiles, sponge rubber, and clothing. Settled in 1697, Shelton was incorporated as a town in 1789 and chartered as a city in 1915. Pop. (1960) 18,190; (1970) 27,165.

SHEM, in the Old Testament, the eldest son of Noah (q.v.), brother of Japheth (see JAPHETIDES), and nephew of Canaan (q.v.). Counted among his descendants are the Hebrews, the Arabs (qq.v.), and the Aramaeans (see ARAM). The designation "Semite" is derived from his name.

SHEMA. See PRAYER, JEWISH.

SHENANDOAH, river of Virginia, formed by the junction of two headstreams, the North Fork

and the South Fork, and flowing from the junction 55 miles N.E. into the Potomac R. at Harper's Ferry, W. Va. It passes through a valley, called Shenandoah Valley, between the Blue Ridge and central Appalachian ranges. The Shenandoah is not navigable. An important source of waterpower, the river contains several hydroelectric power installations. In the Civil War the valley of the Shenandoah was the scene of numerous battles, being successively occupied by the opposing armies and finally laid waste by the Union general Philip Henry Sheridan (q.v.) in 1864–65. See CIVIL WAR, THE AMERICAN.

SHENANDOAH NATIONAL PARK, area of natural interest in Virginia, preserving the highest and most scenic area of the Blue Ridge Mts. (q.v.). Located in the N.W. part of the State, it extends from Front Royal on the N. to Waynesboro on the S., a distance of approximately 75 mi.; the width varies from 2 mi. to 13 mi. Elevations of the mountains in the park vary from 600 ft. to 4049 ft. above sea level, the height of Hawksbill Peak. Mountain streams, forming waterfalls at various levels, flow down into the hollows between the spur ridges. On the mountain slopes and in the hollows, about a hundred varieties of trees and numerous species of wild flowers abound. The park is a wildlife sanctuary. Running along the crest of the mountains, the entire length of the park, is the Skyline Drive, a 105-mi. scenic highway. The park also contains 200 mi. of excellent hiking trails, including 96 mi. of the famous Appalachian Trail (q.v.). The area was the scene of several skirmishes during the Civil War; see CIVIL WAR, THE AMERICAN. The park is administered by the National Park Service (q.v.).

SHEOL. See HELL.

SHEPARD, Alan Bartlett, Jr. (1923–), American astronaut, born in East Derry, N.H., and educated at the United States Naval Academy. After his graduation and commission as an ensign in 1944, Shepard's naval duties included service on a destroyer during World War II; naval flight training followed, and he was graduated from the Navy Test Pilot School, Patuxent River, Md., and from the Naval War College, Newport, R.I. As a pilot he performed tests in high-altitude flying, in-flight fueling, and landing on angled carrier deck.

In 1959 Shepard was named as one of the first seven astronauts; see ASTRONAUT. On May 5, 1961, Shepard became the first American in space, riding the tiny Freedom VII capsule to an altitude of 115 mi. during a 15 min. suborbital flight. Two years later, however, he was grounded with a serious ear condition. An operation in 1969 proved successful, and in February,

1971 Captain Shepard was commander of the Apollo 14 moon mission, during which he spent a record 33.5 hr. on the surface of the moon. He resigned from the navy in 1974. See ASTRONAUTICS: *Man on the Moon*.

SHEPPARD, John, known as JACK SHEPPARD (1702–24), notorious British criminal, born in Stepney (now part of London), England. In 1724 he committed a robbery almost daily in or about London. He was betrayed by an enemy, Jonathan Wild (1682?–1725), a disposer of stolen goods, and was apprehended by the police, tried, and condemned to death. Sheppard escaped through the help of an accomplice Bess Lyon, known as “Edgeworth Bess”. He was rearrested and incarcerated in Newgate prison, London, but again managed to escape. Once more he was arrested, while drunk, and placed under a twenty-four-hour guard. He was hanged at Tyburn. Sheppard’s criminal career was the subject of a number of literary works, including *A Narrative of All the Robberies, Escapes, Etc., of John Sheppard* (1724), reputedly by the English novelist Daniel Defoe, and the novel *Jack Sheppard* (1839) by the British writer William Harrison Ainsworth (qq.v.).

SHERATON, Thomas (1751–1806), British furniture designer, born in Stockton-on-Tees, England. Little is known of his life except that he began to work in London as a furniture designer about 1790. He appears to have lived all of his life in near poverty. Sheraton’s reputation rests on his skills as a designer rather than as a cabinetmaker. His designs often were eclectic, the best of them having a grace and simplicity that place him in the front rank of furniture designers. His late work, less classic and more elaborate, is not as highly regarded. He published several books, the most important of which is *The Cabinet-Maker and Upholsterers’ Drawing Book* (4 vol., 1791–94), with explications and color plates that helped to popularize Sheraton’s design ideas. See CHAIR: *Chairs in Modern Times*; FURNITURE: *18th-Century England*.

SHERBROOKE, city of Canada, in Québec Province and county seat of Sherbrooke Co., at the junction of the Saint Francis and Magog rivers, 80 miles E. of Montréal. It is a commercial center for the surrounding agricultural region. The principal manufactures are textiles, clothing, rubber products, and mining machinery. The city has a largely French-speaking population, and the major educational institution is the French-language Université de Sherbrooke, founded in 1954. The community was founded as Hyatt’s Mills in 1794 by United Empire Loyalists, British subjects who remained loyal to the

crown during the American Revolution (q.v.). It was renamed Sherbrooke in 1818 and was incorporated as a city in 1875. Pop. (1976) 76,804.

SHERIDAN, city in Wyoming, and county seat of Sheridan Co., at the confluence of Big Goose Creek and Little Goose Creek, 135 miles N. of Casper. Sheridan is principally a trading center for a farming, dairying, stock-raising, and coal-mining area. Other industries include a flour mill, a creamery, and sawmills. The city, which lies in a valley at the foot of the Bighorn Mts., is also a popular vacation resort. Numerous historic sites are located in the vicinity, including that of Fort Phil Kearney, built in 1866, and the Fetterman Massacre Monument, commemorating American army officer William Judd Fetterman (1833?–66) and his command, who were killed on the site by Indians in 1866. Sheridan was founded in 1878 and incorporated in 1884. Pop. (1960) 11,651; (1970) 10,856.

SHERIDAN, Philip Henry (1831–88), American army commander, born in Albany, N.Y., and educated at the United States Military Academy. He entered the Civil War (see CIVIL WAR, THE AMERICAN) as a captain in 1861 and a year later was a major general of volunteers. His able leadership of campaigns in Tennessee caused General Ulysses Simpson Grant (q.v.), commander in chief of the Union forces, to appoint Sheridan commander of cavalry in the Army of the Potomac in 1864. During May, 1864, Sheridan’s cavalry cut rail communications about the Confederate capital, Richmond, Va. From August to October, as commander of the Army of the Shenandoah, Sheridan drove the Confederate forces in Virginia out of the Shenandoah Valley; he then devastated the region to prevent it from being used to supply food for the Confederates. During the Shenandoah campaign he defeated forces under General Jubal Anderson Early (q.v.) at Winchester, Fisher’s Mill, and Cedar Creek.

Sheridan became a major general in the regular army in 1864 and took part in the advance of Grant’s army on Richmond in 1865. His victory at the Battle of Five Forks (q.v.) forced the Confederate commander, General Robert E(dward) Lee (see under LEE), to evacuate the capital and withdraw to Appomattox. Sheridan cut off the Confederate line of retreat, and on April 9, Lee surrendered to Grant at Appomattox Court House.

After the war Sheridan commanded American forces on the Mexican border (1865–67) and was appointed military governor of Texas and Louisiana (1867). The severity of his administration in the latter office led President Andrew Johnson (q.v.) to transfer him to the command of the



Union army commander Major General Philip Henry Sheridan at his post in 1864.

Library of Congress

Department of Missouri. In 1884 Sheridan became commander in chief of the U.S. Army, and in 1888, shortly before his death, he attained the rank of general. He was author of *Personal Memoirs* (2 vol., 1888).

SHERIDAN, Richard Brinsley (1751–1816), British dramatist, born in Dublin, Ireland, and educated at the University of Oxford. In 1775 two comic works by Sheridan, a drama *The Rivals* and an opera *The Duenna*, were produced with great success at Covent Garden, London. The score for the opera was written by his father-in-law, the composer Thomas Linley (1732–95), with whom he purchased the Drury Lane Theatre (q.v.) in London between 1776 and 1778. From 1776 Sheridan served as manager of the theater and produced there several of his other witty comedies, among them *The School for Scandal* (1777) and *The Critic* (1779). Sheridan's work is thought to represent the finest development of the artificial comedy of manners in 18th-century England. His two major trademarks were his incisively exaggerated characters and amusing twists of plot. From the name of a humorous character in the early play *The Rivals* derives the widely used term "malapropism", meaning the absurd misapplication of a long word. Sheridan's masterpiece is *The School for Scandal*, a series of gossipy but polished, fast-paced scenes exposing the foibles of fashionable society.

Sheridan became a member of Parliament in 1780, undersecretary for foreign affairs in 1782, and secretary to the treasury in 1783. He later became a close advisor to the Prince of Wales, afterwards the British king George IV (q.v.). The playwright's parliamentary career was notable for his eloquent speeches made in opposition to the British war against the American colonies, in

support of the new French republic, and in denunciation of the British colonial administrator Warren Hastings (q.v.), whose impeachment trial before Parliament lasted seven years.

SHERIFF. See MARSHALS SERVICE.

SHERMAN, city in Texas, and county seat of Grayson Co., in the Red R. valley, 65 miles N. of Dallas. The city is the trading, distributing, and shipping center of a farming, stock-raising, and oil-producing region. The chief manufactures are textiles, electronic equipment, first aid supplies, and processed foods. Sherman is the site of Austin College, a Presbyterian school established in 1849; nearby is Perrin Air Force Base. Sherman was settled in 1849, incorporated as a town in 1854, and chartered as a city in 1895. Pop. (1960) 24,988; (1970) 29,061.

SHERMAN, name of two brothers prominent in United States history.

William Tecumseh Sherman (1820–91), military leader, born in Lancaster, Ohio, and educated at the United States Military Academy. He served for a time in Florida in engagements against the Seminole Indians and was adjutant-general to General Persifor Frazer Smith (1798–1858) at the end of the Mexican War (q.v.); see also SEMINOLE WARS. In 1853 he resigned from the army, having become a partner in a banking firm in San Francisco, Calif. He was president of a military college in Alexandria, La. (now Louisiana State University) from 1859 to the beginning of 1861, when Louisiana seceded from the Union. At the outbreak of the Civil War (see CIVIL WAR, THE AMERICAN) in 1861, he offered his services to the Union Army and was put in command of a volunteer infantry regiment, becoming a brigadier general of volunteers after the first Battle of Bull Run; see BULL RUN, BATTLE OF. Sherman led a division at the Battle of Shiloh

William Tecumseh Sherman (seated, second from left) and his generals during the American Civil War.

Library of Congress



(April 6–7, 1862) and was rewarded for his part in the victory by being promoted to major general of volunteers. Later that year he failed in an attempt (Dec. 27–29) to seize the Confederate stronghold of Vicksburg, on the Mississippi R., but in 1863 he fought under the Union general Ulysses Simpson Grant (q.v.) in the campaign that ended in the capture of that city in July; see VICKSBURG, CAMPAIGN OF. He was given command of the Army of the Tennessee in the fall of 1863 and fought in the Battle of Chattanooga; see CHATTANOOGA, BATTLE OF.

In 1864 Sherman was made supreme commander of the armies in the West and was ordered to move against Atlanta, Ga. During the opening months of the campaign, he lost the Battle of Kennesaw Mountain, and he did not capture Atlanta until almost three months later, on Sept. 1; see KENNESAW MOUNTAIN, BATTLE OF. After ordering the burning of the military resources of the city, he launched his most celebrated military action, known as Sherman's march to the sea, in which, with about 60,000 picked men, he marched from Atlanta to Savannah, Ga., on the Atlantic coast. Along the way the men lay waste the intervening territory and severed the Confederate government at Richmond, Va., from its western States. Sherman next set out to join forces with Grant, who was moving southward toward Richmond. After three months of fighting, Sherman reached Raleigh, N.C., where he was in a position to complete the encirclement of Richmond and its defending forces, led by the Confederate commander in chief Robert E(dward) Lee (see under Lee). Following Lee's surrender on April 9, the Confederate army confronting Sherman surrendered to him at Raleigh, on April 17.

After the war Sherman was commissioned lieutenant general in the regular army and, following the inauguration in 1869 of Grant as President, he was promoted to the rank of full general and given command of the entire U.S. Army. He published his *Memoirs* in 1875 and retired in 1883. The famous phrase "war is hell" is attributed to Sherman.

John Sherman (1823–1900), statesman, born in Lancaster, Ohio, and admitted to the Ohio bar in 1844. He was a member of the Congress of the United States from 1855 to 1877, first in the House of Representatives and after 1861 in the Senate, from which he retired to become secretary of the treasury under President Rutherford Birchard Hayes (q.v.). In 1881, Sherman returned to the Senate, where he served until 1897. He was author of the Sherman Silver Purchase Act of 1890, which provided for the monthly purchase of silver bullion by the government and the issuing of treasury notes based upon it, and the Sherman Antitrust Act (q.v.) of 1890, which forbade combinations, or monopolies, in restraint of trade; see MONOPOLY AND COMPETITION. In 1897 he became secretary of state under President William McKinley (q.v.), but he resigned shortly after the outbreak of the Spanish-American War (q.v.) because of ill health. He was the author of *Recollections of Forty Years in the House, Senate, and Cabinet* (2 vol., 1895).

SHERMAN, James Schoolcraft (1855–1912), American statesman and lawyer, born near Utica, N.Y., and educated at Hamilton College. He was admitted to the bar in 1879. Sherman was mayor of Utica (1884–85) and served ten terms as a Republican member of the United States House of Representatives (1887–91 and 1893–1909). In 1908 he was elected Vice-Presi-

dent of the United States. Sherman served until 1912 with President William Howard Taft (q.v.). He was renominated, but died in office a few days before the election.

SHERMAN, Roger (1721–93), American jurist and statesman, a signer of the Declaration of Independence (q.v.), born in Newton, Mass. Sherman was a shoemaker in early life. In 1743 he moved to New Milford, Conn., where he studied law. He served several terms in the Connecticut legislature between 1755 and 1766. In 1766 he was appointed a judge of the superior court of Connecticut and elected to the Connecticut senate. He was a member of the Continental Congress (q.v.) and served on the Committee of Five appointed to prepare a draft of the Declaration of Independence. Sherman also helped write the Articles of Confederation (q.v.). From 1784 until his death he was mayor of New Haven. His contemporaries considered him a master in the handling of legislation. In 1787 he was a member of the Federal Constitutional Convention at Philadelphia; see CONSTITUTION OF THE UNITED STATES: *The Constitutional Convention*. He also served in the United States House of Representatives from 1789 to 1791 and in the United States Senate from 1791 to 1793.

SHERMAN ANTITRUST ACT, basic Federal enactment regulating the operations of corporate trusts, passed by Congress in July, 1890, through the efforts of the United States Senator John Sherman (see *under* SHERMAN) of Ohio. It declared illegal "every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations". Criminal penalties were provided for violators of the law, and aggrieved persons were entitled to recover three times the amount of losses suffered as a result of the violation. The Sherman Act has been amended and supplemented by several subsequent enactments, notably the Clayton Antitrust Act (q.v.) of 1914. See MONOPOLY AND COMPETITION; TRUSTS.

SHERINGTON, Sir Charles Scott (1857–1952), British physiologist, born in London, England, and educated at the University of Cambridge. He served as professor of physiology at the University of Liverpool from 1895 to 1913, at the Royal Institution of Great Britain from 1914 to 1917, and thereafter until 1936 at the University of Oxford. Sherrington is best known for his physiological studies of the nervous system, which include investigations of the regeneration of nervous tissue and the role of the neuron in the functioning of the nervous system (q.v.). As a result of these investigations with the Brit-

ish physiologist Edgar Adrian (q.v.), he shared the 1932 Nobel Prize in medicine and physiology. From 1920 to 1926 Sherrington was president of the Royal Society, and in 1924 was elected a member of the Order of Merit. His works include *The Integrative Action of the Nervous System* (1906), *Mammalian Physiology* (1916), and *Man on His Nature* (1941).

'S HERTOGENBOSCH (Fr. *Bois-le-Duc*), city in the Netherlands, and capital of North Brabant Province, at the confluence of the Dommel and the Aa rivers, 13 miles N.E. of Tilburg. The principal industries include shipbuilding and the manufacturing of bicycles, cigars, and food products. 'S Hertogenbosch contains several notable medieval buildings, including the 15th-century Cathedral of Saint John and a 16th-century town hall. It was founded by the dukes of Brabant and was chartered as a city in 1184. Pop. (1972 est.) 85,193.

SHERWOOD, Robert Emmet (1896–1955), American dramatist, born in New Rochelle, N.Y., and educated at Harvard University. He held editorial positions with the magazines *Vanity Fair* (1919–20) and *Life* (1920–28) before establishing himself as a popular playwright. His most important plays include *Waterloo Bridge* (1929), *The Petrified Forest* (1935), *Idiot's Delight* (1936; Pulitzer Prize, 1936), *Abe Lincoln in Illinois* (1938; Pulitzer Prize, 1939), and *There Shall Be No Night* (1940; Pulitzer Prize, 1941). During World War II Sherwood served as overseas director of the Office of War Information and was a speech writer for United States President Franklin Delano Roosevelt (q.v.). The motion picture *The Best Years of Our Lives*, for which he wrote the screen play, won the Academy Award in 1946. Among his other works is the biographical study *Roosevelt and Hopkins* (1948; Pulitzer Prize, 1949). He received the gold medal for drama of the National Institute of Arts and Letters in 1941 and the Bancroft Prize for distinguished writing in American history in 1949.

SHERWOOD FOREST, Great Britain, stretch of hilly country in the w. of Nottinghamshire, England, lying between Nottingham and Worksop, and extending about 20 mi. from N. to S. and 5 to 9 mi. from E. to W. It was formerly a royal forest and is associated in tradition with the legendary English outlaw Robin Hood (q.v.). Of the original forest, only a few wooded areas remain. About 12,500 acres, mostly of pine, are now under national ownership.

SHETLAND ISLANDS, Great Britain, archipelago in the North Atlantic Ocean, constituting Zetland County, Scotland, about 50 miles N.E. of the Orkney Islands. The archipelago consists of

about 100 rugged islands and islets, of which only 19 are inhabited. Mainland, which is about 50 mi. long, is the largest of the group. Other important islands are Yell, Unst, Fetlar, Whalsay, Bressay, Muckle Roe, and Fair Isle. Lerwick, on Mainland Island, is the county administrative center and the largest town. The chief industry is fishing, and the islanders also raise cattle and sheep and cultivate crops for their own use. Principal exports are the famous Shetland ponies, and the wool, knitwear, and hosiery that is manufactured by the women. In the 8th and 9th centuries the Shetland Islands were invaded by the Norsemen (q.v.), who ruled them until 1472 when they were added to the domains of the kings of Scotland. In November, 1939, the islands were the target for the first German air raids on Great Britain in World War II. Because of lack of industry and high unemployment, each census since 1871 has shown a new decline in population on the islands. Area, 550.5 sq.mi.; pop. (1971) 17,327.

SHIELD BUG. See STINKBUG.

SHIH HUANG TI, sometimes CH'IN SHIH HUANG TI (259–210 B.C.), Chinese emperor (221–210 B.C.). In 246 B.C. he succeeded under the name of Cheng to the throne of the Chinese feudal state of Ch'in. Cheng subjugated the other feudal states into which China was divided at that time and in 221 B.C. declared himself the sole master of China, assuming the title of Shih Huang Ti, or first emperor, and establishing the Ch'in imperial dynasty. The feudal system was abolished, and the whole country as it existed then was divided into thirty-six (later forty-two) provinces. Reputedly on the advice of his minister of state Li Ssu (d. 208 B.C.), he decreed that all books that disagreed with Ch'in theories of history and philosophy should be burned. The emperor also placed the economy and the defense of the empire under centralized control, constructed roads and canals, and, to protect the country from the inroads of the nomadic Huns (q.v.), he built the major portion of the Great Wall (q.v.) of China. See CHINA, PEOPLE'S REPUBLIC OF: *History: Creation of the Empire: The Ch'in Dynasty.*

SHIHKIACHWANG, city in the People's Republic of China, and capital of Hopei Province, about 160 miles s.w. of Peking. The city is a major railroad junction and terminal and an important trade and manufacturing center. Cotton mills and factories for processing agricultural products and manufacturing chemicals and machinery have contributed to the city's economic growth. The advent of railroads in the first half of the 20th century transformed Shihkiachwang,

a small farm village, into a large industrial city. The Chinese Communist government encouraged business expansion in Shihkiachwang after it came into power in 1949. Shihkiachwang was the administrative center of southern Hopei Province from 1956 to 1967, when it superseded Tientsin as capital of the entire province. Pop. (1970 est.) 1,500,000.

SHI'ITES (Ar. *Shī'ah*, "the party of Ali"), prominent Muslim sect that arose in Persia (now Iran) in the 7th century and effected the first and most important schism in Islam (q.v.). See MUSLIM SECTS.

SHIKOKU, smallest of the four main islands of Japan, s. of the island of Honshu and e. of the island of Kyushu, between the Inland Sea and the Pacific Ocean. Shikoku, which is 140 mi. long and between 30 and 95 mi. wide, is heavily forested and mountainous. The highest peak is Mt. Ishizuchi (6499 ft.). The chief products of the island are fruit, rice, tobacco, and soybeans. The most important industries are fishing, lumbering, and paper manufacturing. Matsuyama and Takamatsu (qq.v.) are the principal cities. Area, 7247 sq.mi.; pop. (1971) 3,910,000.

SHILOH, in the Old Testament, town of the tribe of Ephraim (q.v.), mentioned as the first permanent resting place of the Tabernacle (q.v.), the home in the 11th century B.C. of the judges Eli and Samuel (q.v.), and long the religious center of ancient Israel. Shiloh was destroyed by the Philistines (q.v.) about 1050 B.C.; the site, called Seilun, is 20 miles N. of Jerusalem, in what is now Jordan.

SHILOH, BATTLE OF, or BATTLE OF PITTSBURG LANDING, battle of the American Civil War (see CIVIL WAR, THE AMERICAN). It takes the name Shiloh from that of a meetinghouse, 3 mi. from Pittsburg Landing, that is on the Tennessee R., 9 miles N. of Savannah, Tenn. Here on April 6, 1862, a Confederate army of 40,000 men under General Albert Sidney Johnston surprised and attacked a Union army of 45,000 men under the command of General Ulysses Simpson Grant (qq.v.). During the battle, which lasted from dawn to dusk and was one of the most desperate of the war, the Union troops were steadily driven back, but Johnston was killed, and his successor, General Pierre Gustave Toutant de Beauregard (q.v.), ordered operations suspended a few hours later. The following day Grant, with 25,000 reinforcements under General Don Carlos Buell (1818–98), attacked the Confederates and forced them to withdraw to Corinth. Thus Grant regained all the ground he had lost, and the two-day battle ended without a conclusive victory for either side. Casualties

SHIMIZU

numbered more than 10,000 in each army. A national military park and cemetery commemorating the battle are located at Shiloh; see NATIONAL PARK SERVICE.

SHIMIZU, city and port of Japan, in Shizuoka Prefecture, on Honshu Island, on Suruga Bay, at the mouth of the Tomoe R., 7 miles N.E. of Shizuoka. A port protected by the Miho Peninsula, on the Tokaido railroad, it is in a rice-growing area and exports tea, mandarin oranges, canned and frozen fish, and plywood. Beach resorts are in the suburbs, and the Ryugeji Temple is to the s. Pop. (1970) 234,966.

SHIMONOSEKI, city and port of Japan, in Yamaguchi Prefecture, at the s.w. extremity of Honshu Island, opposite the city of Kitakyushu on Kyushu Island, to which it is connected by railroad and highway tunnels. Shimonoseki is a major fishing port and has important industries, including shipyards, engineering works, metalworks, chemical plants, textile mills, and canneries. The principal tourist attraction is the Shinto shrine dedicated to the Japanese child emperor Antoku (1178–85). Shimonoseki, which was previously known as Akamagaseki and popularly called Bakan, was the scene of the signing of the treaty ending the Sino-Japanese War of 1894–95. Pop. (1970) 258,425.

SHINGLES, in medicine. See HERPES.

SHINN, Everett. See AMERICAN PAINTING: 20th Century.

SHINNECOCK, tribe of North American Indians of Algonquian (q.v.) stock, who were native

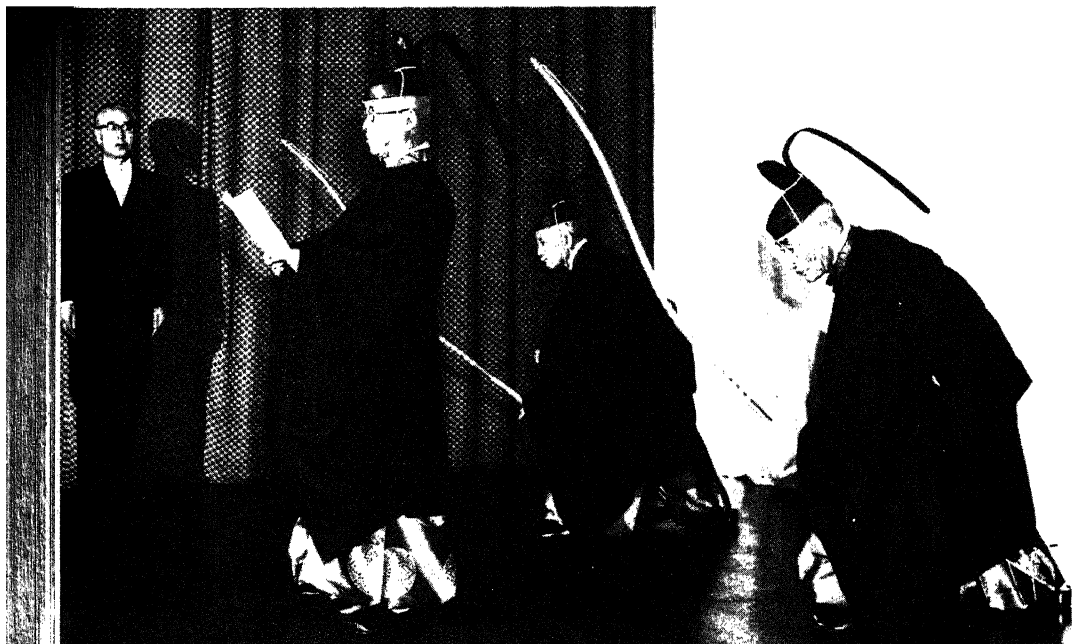
to Long Island, N.Y. After 1788, many Shinnecock formed the Brotherton band with neighboring Algonquian tribes and settled on land given to them in present-day Oneida County, N.Y. In 1833 they moved to Wisconsin, where they were absorbed into the local population. A small number of Shinnecock remained on Long Island, and about 150 of their descendants live near Southampton.

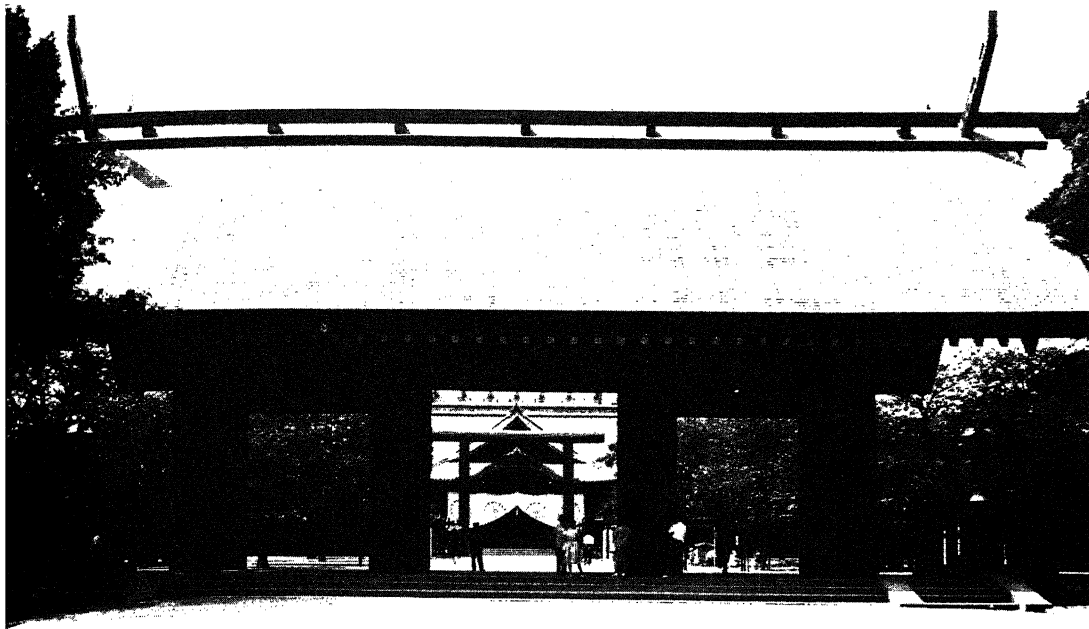
SHINTO (Jap., "the way of the gods"), Japanese cult and religion, originating in prehistoric times, and occupying an important national position for long periods in the history of Japan, particularly in recent times. During the early period of its existence the body of religious belief and practice called Shinto was without a name and had no fixed system of dogma, moral precepts, or sacred writings. Worship centered about a vast pantheon of spirits, or kami (Jap. *kami*, "god"), mainly nature divinities personifying aspects of the natural world, such as the sky, the earth, heavenly bodies, and storms. Rites included prayers of thanksgiving; offerings of valuables, such as swords and armor, and especially cloth; and ablutionary purifications from crime and defilement. See RELIGION: *Primitive Religions*.

In the late 6th century A.D., the name "Shinto" was created for the native religion to distinguish it from Buddhism and Confucianism (qq.v.), which had been introduced from China. Shinto was rapidly overshadowed by Buddhism, and the native gods were generally regarded as manifestations of Buddha (q.v.) in a previous state of existence. Buddhist priests became the custodi-

Shinto priests, wearing traditional robes, perform a ritual prayer ceremony.

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ans of Shinto shrines and introduced their own ornaments, images, and ritual. At the end of the 8th and the beginning of the 9th century, the celebrated Japanese teacher Kukai, or (posthumously) Kobo Daishi (774–835), established a doctrine uniting Buddhism and Shinto under the name of Ryobu Shinto (Jap., “the Shinto of two kinds”). In the new religion, Buddhism dominated Shinto; and elements were adopted from Confucianism. The ancient practice of Shinto proper virtually disappeared and was maintained only at a few great shrines and in the imperial palace, although the emperors themselves had become Buddhists. The distinctively Shinto priests became fortunetellers and magicians.

Beginning in the 18th century, Shinto was revived as an important national religion through the writings and teachings of a succession of notable scholars, including Mabuchi (1697?–1769), Norinaga Motoori (1730–1801), and Atsutane Hirata (1776–1843). Motivated by nationalistic sentiments that took the form of reverence for Japanese antiquity and hatred for ideas and practices of foreign origin, these men prepared the way for the disestablishment of Buddhism and the adoption of Shinto as the state religion. In 1867 the shogunate was overthrown and the emperor was restored to the head of the government. According to revived Shinto doctrine, the sovereignty of the emperor was exercised by divine right through his reputed descent from the sun goddess Amaterasu Omikami, who is considered to be the founder of the Japanese nation. Concomitant beliefs included the doc-

The inner gate of the Yasukuni Shrine, Tokyo, a national sanctuary dedicated to the soldiers who died in battle for Japan.

Japan Information Service

trines that the Japanese were superior to other peoples because of their descent from the gods, and that the emperor was destined to rule over the entire world. Until the defeat of Japan in World War II, these beliefs were of the utmost importance in assuring popular support for the military expansion of the Japanese Empire. See *JAPAN: History*.

Modern Shinto. Before 1946 Shinto took two forms: State, or Shrine, Shinto, a patriotic nationalistic cult, identified with and financially supported by the imperial government; and Sectarian Shinto, a general term for a number of sects founded by private persons and based on various interpretations of traditional Shinto. State Shinto, as the official government cult, theoretically embodied the religious beliefs of the entire Japanese people, and the number of its adherents was counted as the total population of the empire. The cult centered about a great profusion of shrines in all parts of the country, ranging from small wayside chapels commemorating local spirits and families to great national sanctuaries, such as the Yasukuni shrine, Tokyo, dedicated to the spirits of soldiers who had died in battle for Japan. In 1946, during the American occupation of Japan following World War II, the cult was completely separated from the state by order of General Douglas MacArthur (q.v.), supreme commander for the Allied Powers. Government financial support of State Shinto was eliminated, the

SHIPPING

former practice of teaching cult doctrines in the schools was abolished, and the use of Shinto symbols for nationalistic purposes was forbidden. At the same time the emperor issued a statement renouncing all claims to divinity.

Sectarian Shinto, a religion of the same status as Buddhism and Christianity (q.v.), was unaffected by these changes. At the present time it comprises thirteen major and numerous minor sects. The principal sects are divided into five main groups: those that continue with little modification the traditions of ancient Shinto; those that emphasize adherence to Confucian ethics; those that are predominantly devoted to faith healing; those that practice the worship of mountains; and those that are primarily devoted to purification rites. In the late 1960's the various Shinto sects had about 67,750,000 followers. There are approximately 185,000 priests and teachers in these sects and more than 80,000 Shinto shrines. One of the best and most recent works on the subject is *Shinto: The Way of Japan* (1965) by the American educator and clergyman Floyd H. Ross (1910–). A.W.W.

SHIPPING, operation and management of vessels engaged in the commercial transportation by water of passengers and goods in domestic and international trade.

TRADE ROUTES

Shipping services are distributed among eight major trade routes linking principal geographic areas.

The North Atlantic route is the most important in terms of volume of cargo, value of goods, and number of passengers. This route connects Atlantic ports of western Europe with those of eastern North America. The largest, fastest, and most luxurious passenger ships, as well as hundreds of cargo vessels, are employed on the North Atlantic route.

The Mediterranean-Asian, or Suez Canal (q.v.), route, serving most of the land area of the world and a major part of its population, is second in importance. It links the Americas and Europe to East Africa, India, Indonesia, China, Japan, and Australia by the Mediterranean Sea and the Suez Canal.

The Panama Canal (q.v.) route reduces the shipping distance between the coast of Europe and the west coasts of North and South America. Traffic between the Atlantic seaboard of the United States and Australia, China, and Japan often uses the Panama rather than the Suez route.

Other routes include the South African, connecting the Atlantic ports of Europe and the Americas with the ports of Africa; the South

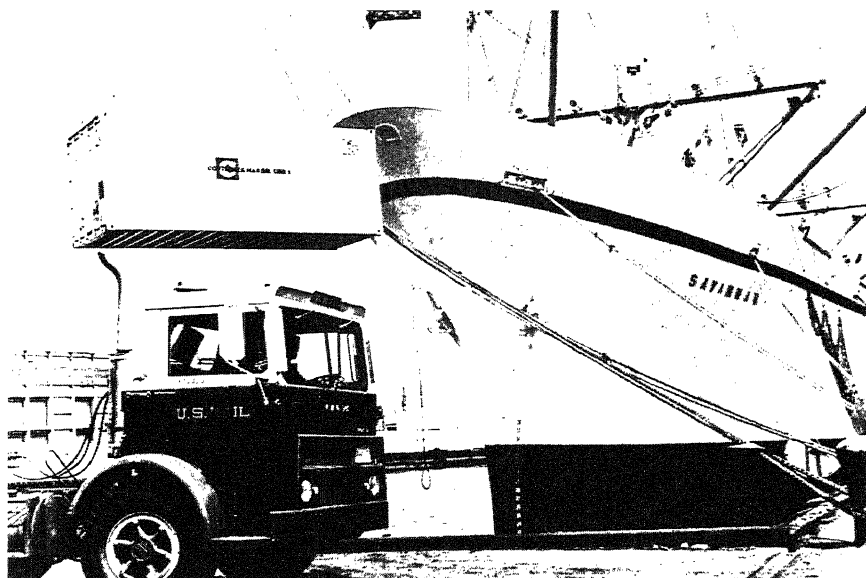
American, linking the Atlantic coasts of Europe and North America to Brazil, Uruguay, and Argentina; the Caribbean route, connecting Europe and North America with the Caribbean countries; and the western North American-western South American route, linking the Pacific coasts of North and South America. In addition, the North Pacific route connects the Pacific coasts of Canada and the U.S. to Japan and China, and the South Pacific route links the Pacific coasts of the U.S. and Canada to New Zealand and Australia.

Coastwise Shipping. Technically, coastal shipping is conducted within 20 mi. of the shoreline, but in practice ship lanes often extend beyond that distance, for reasons of economy and safety of operation. In the U.S., coastal shipping is conducted along the Pacific, Atlantic, and Gulf coasts. Under the restriction known as cabotage, the U.S. and many other nations permit only vessels registered under the national flag to engage in coastal trade. Among many small European countries cabotage does not apply, and short international voyages are common. A special feature of coastal shipping in the U.S. is the trade between the Pacific coast and the Atlantic and Gulf coasts. Vessels engaged in this trade traverse the open sea and utilize the Panama Canal; however, they are covered by cabotage laws.

Great Lakes Shipping. In 1972 a fleet of more than 360 American and Canadian ships was engaged in the movement of bulk cargoes on the Great Lakes (q.v.). In the same year more than 84,000,000 tons of iron ore and about 26,700,000 tons of grain were transported over Great Lakes routes. The Saint Lawrence Seaway (q.v.), which was opened in 1958, enables oceangoing ships to reach Great Lakes ports. Traffic through the seaway system in 1972 totaled more than 52,000,000 tons of U.S. and Canadian traffic and some 20,465,000 tons of foreign traffic. Of the total, oceangoing ships carried 33 percent and lakers 67 percent.

Inland-Waterways Operations. The inland waterways of the U.S. have an aggregate length of about 25,380 mi. In 1974 about 4300 self-propelled towboats and tugs, and 18,000 barges and scows were in operation on the waterways. In 1972 about 597,255,000 tons of cargo were transported. In Europe a similar network of canals and rivers provides an economical method of moving goods; see CANAL. A close relationship exists between deep-sea and inland-waterway shipping because millions of tons of cargo are transshipped between inland points along the waterways and overseas ports. This relationship

The body of a trailer truck, a cargo container, is hoisted aboard the nuclear merchant ship Savannah before a voyage to Europe. American Export Isbrandtsen Lines, Inc.



is expected to grow closer as lighter-aboard-ship and barge-aboard-ship operations became common; see *Vessel Types and Tonnage*, below.

NATURE OF THE SHIPPING INDUSTRY

Shipping is a private, highly competitive service industry. The activity of the industry is divided into several categories, namely, liner service, tramp shipping, industrial service, and tanker operation.

Liner Service. Liner service consists of the regularly scheduled operation of ships between designated ports on fixed routes. Cargoes are accepted under a contract known as a bill of lading, issued by the ship operator to the shipper.

Passenger fares are established according to the amount and quality of the service provided the traveler and vary with the age, size, speed, and appointments of the ship. Freight rates are established on the basis of a thorough study of the characteristics of the various commodities carried on each route. The rates are listed in a so-called freight tariff, from which shippers may determine the charges for transporting their goods.

Competition in liner service is regulated generally by agreements, known as conferences, among the shipowners. These conferences stabilize conditions of competition and set passenger fares or freight rates for all members of the conferences. In the U.S., steamship conferences are supervised by the Federal Maritime Commission in accordance with the Shipping Act of 1916. Rate changes, modifications of agreements made by the conferences, and other joint activities must be approved by the commission before the regulations become effective. Rebates or other measures designed to eliminate

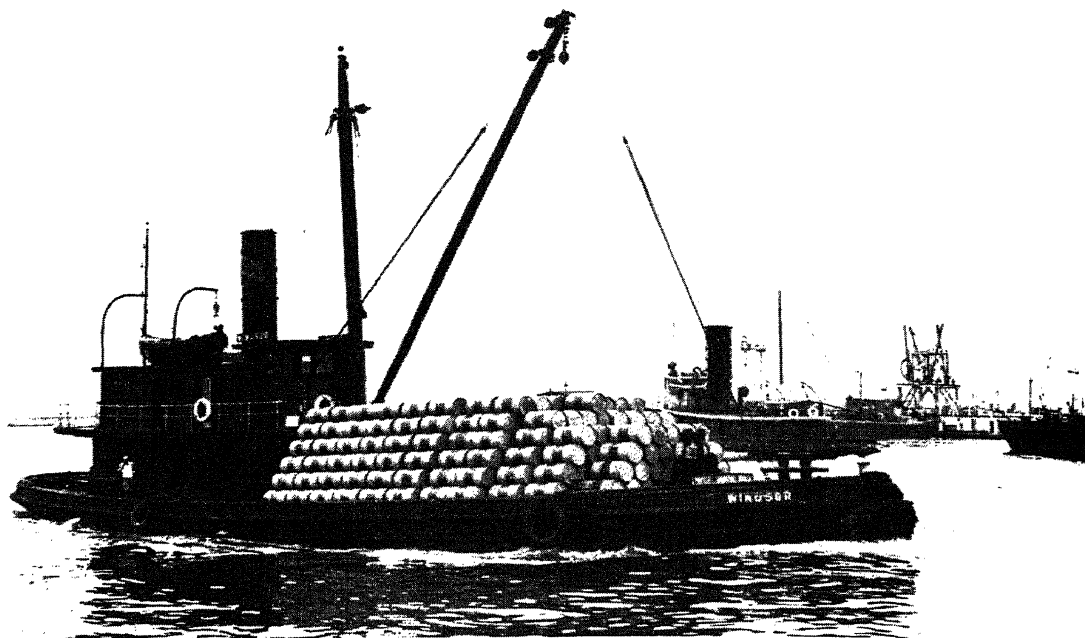
or prevent competition are prohibited by law.

Tramp Shipping. Tramps, known also as general-service ships, maintain neither regular routes nor regular service. Usually tramps carry shipload lots of the same commodity for a single shipper. Such cargoes generally consist of bulk raw or low-value material, such as grain, ore, or coal, for which inexpensive transportation is required. About 30 percent of U.S. foreign commerce is carried in tramps.

Tramps are classified on the basis of employment rather than of ship design. The typical tramp operates under a charter party, that is, a contract for the use of the vessel.

The center of the chartering business is the Baltic Exchange in London, England, where brokers representing shippers meet with shipowners or their representatives to arrange the agreements. Freight rates fluctuate according to supply and demand: when cargoes are fewer than ships, rates are low. Charter rates are also affected by various other factors, such as crop failures, threats of war, and other political crises.

Charter parties are of three kinds, namely the voyage charter, the time charter, and the bareboat charter. The voyage charter, the most common of the three, provides transport for a single voyage, and designated cargo between two ports in consideration of an agreed fee. The charterer provides all loading and discharging berths and port agents to handle the ship, and the shipowner is responsible for providing the crew, operating the ship, and assuming all costs in connection with the voyage, unless an agreement is made to the contrary. The time charter provides for lease of the ship and crew for an agreed period of time. The time charter does not specify the cargo to be carried, but places



A lighter carrying barrels of lubricating oil in the Kill van Kull, a channel leading into the Upper New York Bay. Such lighters can be loaded aboard newly developed vessels called lighter-aboard ship (LASH), which can deliver them to any port without the need for berthing.
Standard Oil Co. (N.J.)

the ship at the disposal of the charterer, who must assume the cost of fuel and port fees. The bareboat charter provides for the lease of the ship to a charterer who has the operating organization for complete management of the ship. The bareboat charter transfers the ship, in all but legal title, to the charterer, who provides the crew and becomes responsible for all aspects of its operation.

The leading tramp-owning and tramp-operating nations of the world are Norway, Great Britain, the Netherlands, and Greece. The carrying capacity of a typical, modern, well-designed tramp ship is about 12,000 tons deadweight (dwt.), that is, when it is fully loaded with fuel, water, stores, and cargo; its speed is about 15 knots. The recent trend is toward tramps of 30,000 dwt., without much increase in speed.

Industrial Carriers. Industrial carriers are vessels operated by large corporations to provide transportation essential to the processes of manufacture and distribution. These vessels are run to ports and on schedules determined by the specific needs of the owners. The ships may belong to the corporations or may be chartered. For example, the Bethlehem Steel Corporation maintains a fleet of Great Lakes ore carriers, a number of specialized ships that haul ore from South America to Baltimore, Md., and a fleet of dry-cargo ships that transports steel products from Baltimore to the Pacific coast; the Standard

Oil Company of New Jersey maintains large fleets of deep-sea tankers, towboats, and river barges to carry petroleum to and from refineries.

Tanker Operation. All tankers are private or contract carriers. In 1973 some 34 percent of the world tanker fleet, which aggregates about 200,000,000 dwt., was owned by oil companies; the remaining tonnage belonged to independent shipowners who charter their vessels to the oil companies. So-called supertankers, which exceed 100,000 tons dwt., are employed to transport crude petroleum from the oil fields to refineries. The refined products, such as gasoline, kerosene, and lubricating oils, are distributed by smaller tankers, generally less than 30,000 dwt., and by barges. See PETROLEUM: Transportation.

VESSEL TYPES AND TONNAGE

Merchant ships are classified as passenger carriers, cargo ships, and tankers.

Passenger Carriers. These ships fall into three categories, depending on a combination of size, speed, and carrying capacity. The fastest and largest ships are the transatlantic superliners. Vessels in this category are more than 900 ft. long, have a gross tonnage in excess of 50,000, carry 2000 or more passengers, and maintain precise schedules across the North Atlantic Ocean. In the late 1960's only three such ships were in service: the *United States*, an American vessel, which had a top speed of 42 knots, or more than 48 land m.p.h., and was retired from service in 1970; the British-owned *Queen Elizabeth*, which was retired in 1969; and the French-owned *France*, the longest ship in the world.

The British superliner *Queen Elizabeth II* made its maiden voyage in 1969.

Next in order are the express liners, which range from 20,000 to 50,000 gross tons and have space for 750 to 1500 passengers. These vessels also operate on fixed schedules and depend mainly on passengers for revenue. Express liners operate on many of the routes linking the various ports of the world and in the cruise trade.

The third category is the combination passenger-cargo ship, which ranges in size from about 10,000 to 20,000 gross tons and carries from 50 to 500 passengers. Cargo provides the major portion of the earnings of these vessels.

Cargo Ships. These carriers are divided into two major categories, namely, cargo liners and tramps. Cargo ships carry packaged goods, unitized cargo (cargo in which a number of items are consolidated into one large shipping unit for easier handling), and limited amounts of grain, ore, and liquids such as latex and edible oils. A few passengers are accepted on some cargo liners. In recent years specialized ships have been designed and built to carry certain types of cargo, for example, automobiles or grain.

Container Ships. In the late 1950's container ships set the pattern for technological change in

cargo handling and linked the trucking industry to deep-sea shipping. These highly specialized ships carry large truck bodies and can discharge and load in one day, in contrast to the ten days required by conventional ships of the same size. The container ship began its rapid development in 1956, when Sea Land Service commenced operations between New York City and Houston, Texas. By 1973 the U.S. merchant fleet was operating 129 partial or full container ships. Early operations were solely domestic, but by the early 1970's foreign development had moved rapidly, particularly in the North Atlantic trades.

BARGE-ABOARD SHIP OR LIGHTER-ABOARD SHIP. This ship, also called seabee (sea barge) or LASH (lighter-aboard ship), is an evolutionary development of the containership. Contracts for such ships, 875 ft. long, with a 106-ft. beam, an approximate capacity of 20,000 dwt., and a 20-knot speed, were approved in 1967, and the ships were in operation in the early 1970's. They are capable of carrying about thirty-eight barges, or up to 1600 containers, or a combination of con-

Oceangoing ships are loaded with automobiles at Detroit, Mich., 1000 mi. inland, a port on the Saint Lawrence Seaway. In the background is the Ambassador Bridge, linking Detroit and Windsor, Ontario.

Detroit Convention & Tourist Bureau



SHIPPING

tainers and barges. Their design enables them to deliver cargo to developed or undeveloped ports, without the need for berthing.

BULK CARRIERS. Bulk carriers suitable for dry cargo also began to increase in size. Ships of 60,000 dwt. were common in the 1960's. In 1972 there were 147 bulkers of 100,000 to 200,000 tons and 14 bulkers of 200,000 to 300,000 tons.

Tankers. Tankers are designed specifically to carry cargoes of petroleum or other liquids. Until 1940 the typical tanker was a vessel of about 10,000 to 12,000 dwt., with a speed of 10 knots. During World War II the U.S. government designed and built 544 so-called T-2 tankers, which had a deadweight of about 16,500 tons and a speed of 14½ knots. The prototype of the supertanker was the *Phoenix*, of 23,910 dwt., built in 1944 in Norfolk, Va. Supertankers have a capacity exceeding 30,000 dwt.

Specialized tankers transport molasses, wine, liquefied petroleum gas, liquid chemicals, or refrigerated products. A new type of ship, the combination ore-and-oil carrier, is designed to transport alternate cargoes of petroleum and iron ore. In the early 1970's more than 200 such ships were in service. At the same time, the liquefied natural gas (L.N.G.) carrier became a significant factor in shipbuilding. In 1972 the U.S. had on order nearly 50 tankers and L.N.G. carriers. The U.S. shipyards dominated the world market for construction of offshore oil-drilling rigs and platforms.

Mammoth Tanker. Tankers of more than 100,000-dwt. capacity entered the world fleet in 1959, when the *Universe Apollo* was built in Japan. By 1972 some 440 tankers of 100,000 dwt. or over were operating or on order. The world's largest ship, the 477,000-dwt. tanker *Globtik Tokyo*, designed to carry 130,000,000 gal. of crude oil, was launched at Kure, Japan, in 1972; other mammoth tankers were under construction. Plans were being considered for 500,000-tonners, and a tanker of 1,000,000 dwt. was considered feasible. Because of their deep draft and overall size, such ships cannot traverse the interocean canals, such as the Panama Canal. It is necessary and less expensive for these ships to take the long routes around Africa and South America with full loads.

In 1969, the S.S. *Manhattan*, a 150,000-ton ice-breaking tanker, became the first commercial ship to traverse the Northwest Passage when it pioneered a route to the vast oil reserves discovered at Prudhoe Bay, Alaska. See also ARCTIC, THE: *Exploration of the Arctic Regions*.

REGULATIONS AND SUBSIDIES

Many treaties and conventions have been

adopted over the years with the objective of increasing the safety of life at sea. One of the most important agreements provided for the establishment of the International Iceberg Patrol in 1913, after the *Titanic* disaster (q.v.). Under the International Load-Line Convention of 1930, ship loading was regulated on the basis of size, cargo, and route of the vessel. The International Convention for the Safety of Life at Sea, which governs ship construction, was ratified by most maritime nations in 1936 and updated in 1948.

The U.S. government grants shipbuilding and ship-operating subsidies to operators of national-flag vessels to enable them to meet foreign competition. The Merchant Marine Act of 1936 sets forth the U.S. policy of assistance to American shipping; see MERCHANT MARINE OF THE UNITED STATES: *Government Subsidies*.

Foreign governments assist their merchant fleets in various ways. Certain governments provide ship-construction subsidies to aid the national shipbuilding enterprises. The Italian merchant marine, which is nationally owned, receives financial aid as required. French policy includes direct operational subsidies, cargo preference, and financial assistance in shipbuilding. The Netherlands and the Scandinavian countries have no subsidy programs.

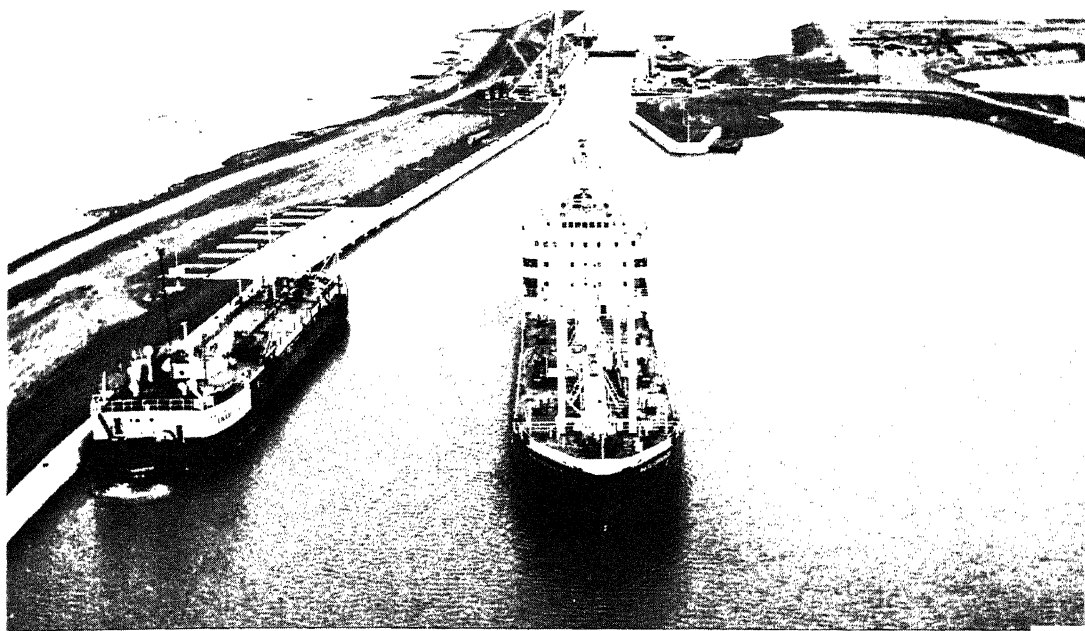
HISTORY

Commercial shipping began with the activities of the Phoenician merchants. They operated their own vessels, transporting goods to and from the centers of trade. The practices they developed were adopted by the merchants of ancient Greece and Rome and were continued by the maritime powers through the Middle Ages to modern times. The Venetians, from 1300 to 1500, owned a huge merchant fleet that served the interests of the merchant traders and the city-state exclusively. From 1600 to 1650 the Dutch ranked first in shipping activity, operating a globe-circling tramp service for merchants of western Europe.

Advances in the 19th Century. Until the 19th century ships were owned by the merchant or by the trading company; common-carrier service did not exist.

On Jan. 5, 1818, the full-rigged American ship *James Monroe*, of the Black Ball Line, sailed from New York for Liverpool, inaugurating common-carrier line service on a dependable schedule. A policy of sailing regularly and accepting cargo in less-than-shipload lots enabled the Black Ball Line to revolutionize shipping.

Two technological developments furthered progress toward present-day shipping practices. In the first, the American sailing ship *Savannah*



The Côte Sainte Catherine Lock, in the Montréal area of the Saint Lawrence Seaway, built to bypass the La-chine Rapids (out of sight on the left). In the foreground an oceangoing ship moves upstream after leaving the lock, which has a lift of 30 ft. Canadian Consulate

made an Atlantic crossing in 1819 under steam propulsion for part of the voyage, pioneering the way for the British ship *Sirius*, which crossed the Atlantic entirely under steam in 1838. The other step forward was the introduction of iron into shipbuilding when the sailing vessel *Iron-sides* was launched in Liverpool in 1838.

The opening of the Suez Canal in 1869 was of great economic importance to shipping. Coinciding with the perfection of the triple-expansion reciprocating engine, which was both dependable and economical in comparison with the machinery of the pioneer vessels, the completion of the canal made possible rapid service between western Europe and Asia. The first steam-propelled ship designed as an oceangoing tanker was the *Glückauf*, built in Great Britain in 1886. She had 3020 dwt. and a speed of 11 knots.

Among other technological advances in the 19th century was the development by the British inventor Charles A. Parsons (1854–1931) of the compound steam turbine, adapted to maritime use in 1897; see STEAM AND STEAM ENGINEERING: *Steam Turbines*. In 1903 the *Wandal*, a steamer on the Volga R., was powered by the first diesel engine used for ship propulsion. The Danish vessel *Selandia* was commissioned as the first seagoing motor ship in 1912.

The 20th Century. After World War I significant progress was made especially in the perfection of the turboelectric drive; see GAS TURBINE. The French Line put into service (1935) the first vessel more than 1000 ft. long, the turboelectric superliner *Normandie*; this ship was operated

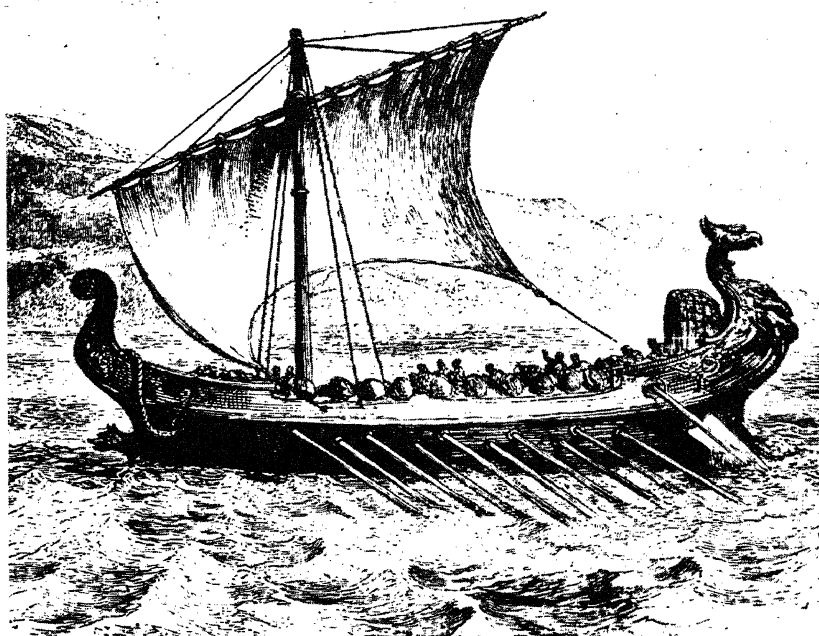
between New York and Europe with conspicuous success until the outbreak of World War II in 1939. She was seized in 1941 by the U.S. government. During conversion to a troop transport, fire broke out on board. Water used by the firefighters caused the ship to capsize and the ship became a total loss.

During World War II, welding in ship construction was developed to such a degree that riveting is now rarely used. In 1952 the newly built *United States* established a speed record for merchant ships by making the passage from New York to Southampton, England, in 3 days, 10 hr., 40 min., at an average speed of 35 knots. The keel of the first nuclear-powered passenger-cargo ship, the *Savannah*, was laid in Camden, N.J., on May 22, 1958. In the first three years of operation the *Savannah* made voyages to demonstrate the peaceful application of atomic power; in 1962 it was chartered to a private company for experimental commercial use. Before partial refueling in August, 1968, the vessel had traveled almost 332,000 mi., using only 122 lb. of the isotope uranium-235. The *Savannah* is designed to cruise at 21 knots. See also NAVAL ARCHITECTURE; SHIPS AND SHIPBUILDING; TRANSPORTATION.

L.C.K.

SHIPS AND SHIPBUILDING. Ship is the general term for any type of large buoyant vessel in which men travel or transport goods over the surface of the water. The term "boat" (q.v.) usu-

Phoenician merchant galley, 7th century B.C.
Bettmann Archive



ally denotes smaller types of vessels, but there is no generally accepted criterion of differentiation. The term "shipbuilding" is applied to the construction of large vessels. See also **BOATBUILDING**.

EARLY TYPES OF VESSELS

Primitive tribes used rafts, skin- or bark-covered canoes, and dugout canoes for water travel. In the most advanced type of primitive vessel a wooden framework of ribs and longitudinal pieces was covered with a skin of comparatively thin wooden planks. Modern types of ships used in Europe have, in general, developed from the early boats used by the Egyptians.

Egyptian Vessels. The earliest known Egyptian boats employed a wood framework covered with wooden planking and were large enough to accommodate at least twenty oarsmen and to carry a cargo of several head of cattle or an equivalent weight of goods. The earliest pictorial records of such vessels date back as far as 3000 B.C., and ships of this type were probably in use for some time prior to that date. Boats illustrated in early Egyptian paintings were equipped with a double mast, joined at the top, from which sails were hung. In later types a single mast was used and the sails were hoisted by means of rollers at the top of the mast. Steering, in all the early Egyptian vessels, was accomplished by means of one or more steering oars or sweeps that projected over the stern of the vessel. When more than one oar was used in

steering, the steering oars were attached to each other and were directed by means of a single steering arm or tiller.

Phoenician Vessels. The most able shipbuilders of ancient times were the Phoenicians, who constructed merchant vessels, which were capable of carrying large cargoes, and also warships larger and more effective than any of those built by their contemporaries. One of the most important innovations introduced by the Phoenicians was the use of two or more banks of oars for the propulsion of their ships, permitting a larger number of rowers to work in a single vessel. The bireme (two-banked vessel) and the trireme (three-banked vessel) were apparently invented by the Phoenicians. These multibanked rowing vessels were supplanted in Greek times by quadremes and quinqueremes, four- and five-banked types, which were faster and more powerful than the bireme or trireme. All types of Phoenician ships usually carried a single mast bearing an auxiliary sail. See **GALLEY**; **ROWING**.

Greek Ships. Although no evidence is extant, the framework of the Greek and other classic galleys supposedly was made of naturally curved timber, or crooks, in a manner similar to that used in present-day shipbuilding. A superstructure was built at the after end of the deck to house and protect the captain and officers and at the forward end of the ship the deck was also raised to form a structure called a fore-castle. Other features of the classic galley included

a series of girdles of rope which were strung around the sides of the ship in a fore-and-aft direction and arranged so that they could be tightened by levers at the rear of the vessel. These girdles served a double purpose: they strengthened the ship against the shock attendant upon ramming another ship and also functioned as a longitudinal truss. The galleys were equipped also with one or two masts for sailing, but sails were not used when a galley was engaged in battle. The crew of a Greek ship of war comprised approximately 220 men, most of whom were oarsmen.

Roman Ships. Early Roman warships were similar to classical Greek warships, but after the Carthaginian wars in the 5th century B.C., the Romans concentrated on building heavier vessels equipped with four or five banks of oars. They also developed several types of bridges that could be lowered or dropped upon the decks of enemy warships. These devices were so successfully used by boarding parties that the tactic of ramming enemy vessels was all but abandoned, and Roman warships depended entirely upon long-distance attacks by means of ship-mounted catapults and other siege machinery, followed by boarding. During the naval Battle of Actium (see ACTIUM, BATTLE OF) in 31 B.C., however, the heavy Roman galleys were decisively defeated by light Liburnian biremes, which were able to dodge the missiles thrown by the heavier vessels and to ram and break away the oars of the Roman galleys, leaving them defenseless. As a result of this battle, the Romans turned to the construction of biremes and employed this type of ship almost exclusively for several centuries. For commerce and the carrying of cargo still larger vessels were built, as much as 175 ft. in length, 44 ft. in breadth, and approximately the same in overall depth. Even larger ships are believed to have been built for the transportation of obelisks from Egypt to Rome. These large cargo ships were rigged with square sails on three masts and are supposed to have carried a topsail above the mainsail on the mainmast.

The final development of the Roman warship was the dromond, a swift galley with one or two banks of oars, which was used in the 5th century A.D. During this period and later, warships were improved by the addition of various forms of protective coverings, such as leather and vinegar-soaked cloth, to guard against the incendiary and explosive missiles which had become a part of naval armament.

Norse Ships. Concurrent with the improved Roman galleys were the highly efficient long

ships, which were ocean-going vessels propelled by both oars and sails, developed by the Norsemen and Danes in Scandinavia. The smallest class of these ships, called *snekkja*, had about thirty oars and larger classes had sixty-four or even more. The remains of a *snekkja*, found in a burial mound in Norway during the latter part of the 19th century, was 78 ft. in length, 16½ ft. in width, and slightly under 6 ft. in depth. The round ship, or *skuta*, which was primarily a sailing vessel that could be rowed also, was used in Viking expeditions to Greenland and Iceland, and also by the various Scandinavian kings who invaded the British Isles. This type of ship was adapted by the Saxons, notably under Alfred the Great (q.v.), for defense against raiders.

SHIPS OF THE MIDDLE AGES

Ships used during medieval times were, in general, developments of the Roman galleys, but differed from the earlier types in that much longer oars, or sweeps, were used. These oars frequently were as much as 50 ft. in length and were powered by as many as seven rowers at each oar. The inboard portions of the oars were counterbalanced and equipped with handles; the rowers were arranged in tiers on ramps. To provide greater leverage for the long oars, the tholes, or pins, against which the oars were pulled were mounted outside the hull of the ship on a wooden framework, called an *apostis*, running parallel to the centerline of the ship. First used on ancient galleys and reintroduced on medieval ships, the *apostis* had the same purpose as the outriggers used on modern racing shells. Use of the *apostis* also facilitated the arranging of the oars in two or more banks on each side of the vessel.

Other improvements introduced in the Middle Ages included the use of a permanent rudder hung from the sternpost of the ship in place of the steering oars used by the Romans. In addition, the boats of later medieval times were made with greater freeboard (higher sides above the waterline) to make them more suitable for use in rough or stormy seas.

The typical warship of the Middle Ages was the medieval galley, which was brought to perfection by shipbuilders of the Mediterranean area, particularly by the builders of Genoa and Venice. Galleys varied in length from 100 to 200 ft. and were commonly propelled by twenty oars on each side together with sails rigged on two or three masts. The galleys were armed with cannon on the forecastle and on the high poop deck at the stern. In later models of the galleys, guns were also mounted to fire broadside over

SHIPS AND SHIPBUILDING

the bulwarks of the ship, and, still later, to fire through openings or ports in the bulwarks. The larger galleys carried complements of as many as 1200 men.

Until the end of the Middle Ages no very clear distinction was made between naval and merchant sailing ships; vessels with sails were used both as warships and as merchantmen. Oared ships were restricted largely to military purposes. At about the beginning of the 15th century, however, various nations began to develop distinctive types of vessels for fighting and trade. A typical merchant ship of the late Middle Ages was the carrack, a strongly built, three-masted vessel, carrying two courses of square sails on the foremast and mainmast and a lateen sail on the short mizzenmast. Such ships were equipped with only a limited amount of armament and were designed primarily for the carrying of cargo.

Sailing Ships. At about the end of the Middle Ages, the use of oars for propulsion began to give way to the exclusive employment of sails, particularly in vessels built in northern Europe for use in the Atlantic Ocean. The Mediterranean nations, particularly Italy, continued to build galleys, and as late as 1571 the Christian fleet which fought the Turks at the Battle of Lepanto (q.v.) was composed almost exclusively of galleys. Subsequently, various classes of rowing-and-sailing warships, such as the galleon, were developed by the Mediterranean nations; these types replaced the galley ships by the late 1700's.

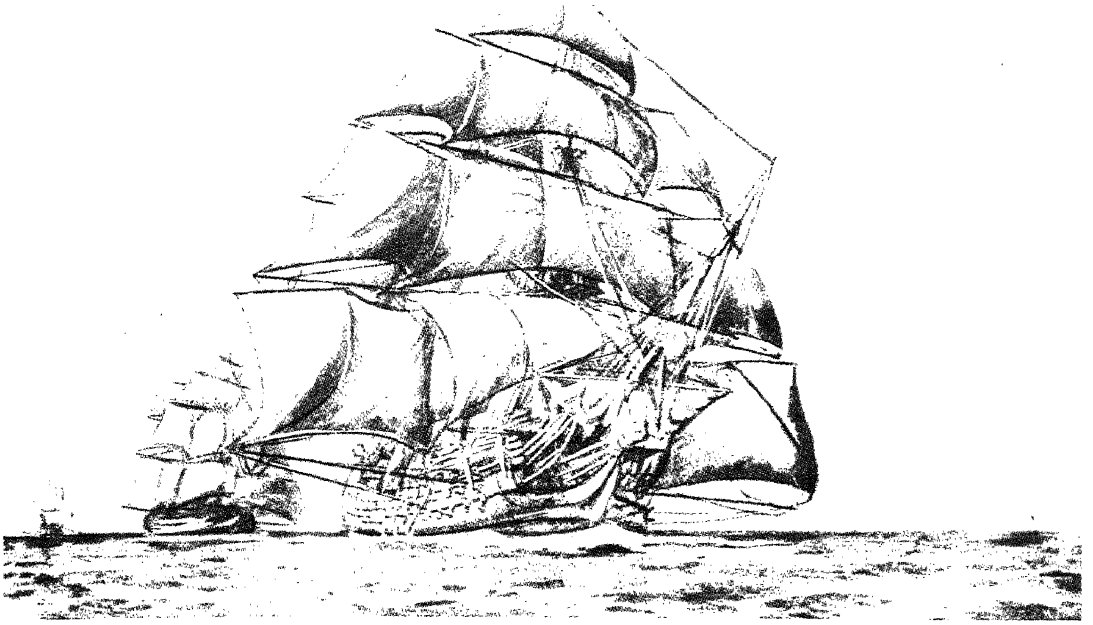
Early European Types. With the introduction of vessels powered exclusively by sails, a number of different types was developed. The caravel, typical of Portugal and Spain, was a comparatively small vessel of approximately 125 tons burden, but sometimes larger or smaller. The size of ships in terms of tonnage can be calculated in two ways: tons of burden, which is the weight of cargo which a ship will carry; and displacement tonnage, which is the weight of water displaced by the floating vessel and therefore equal to the combined weight of the ship and its cargo. The tonnage of modern merchant ships is always given in terms of burden and that of modern warships in terms of displacement. In shape the caravel had broad bows and a high, narrow poop. It was rigged with three or four masts, of which only the foremast carried a square sail, while the others carried lateen sails. The ships in which the Italian-born navigator Christopher Columbus (q.v.) sailed on his voyages of discovery were caravels.

The typical warship built by the English and

French during the 16th and 17th centuries was the so-called great ship, with four or five masts, a high forecastle and poop, and two or more tiers of guns. In size these ships reached displacements of 1000 tons or more and carried armaments of sixty guns or more. Later armaments were increased, particularly in the British navy, so that ships of 100 guns were not uncommon. The flagship of Horatio Nelson (q.v.), the H.M.S. *Victory*, built in the middle of the 18th century, typified the large men-of-war of its period. The *Victory* was 186 ft. in length, 52 ft. in beam or width, and her displacement was 2162 tons. Lighter types of warship were the frigate and sloop, or corvette, full-rigged ships, carrying thirty-six or fewer guns, usually all mounted on deck rather than below decks as in the great ships, or ships of the line. Other small naval vessels of the 18th and 19th centuries included brigs, brigantines, schooners, cutters, and luggers. For present-day naval vessels, see SHIPS, NAVAL.

American Types. English ships for both fighting and merchant use, and to a lesser extent the ships of the French and Spanish, were generally built very heavily and with rounded lines, and as a result were not particularly fast. American shipbuilders, however, had developed by 1750 fast-sailing sloops and schooners, which easily outsailed comparable vessels of other nations. These ships, which were used for illegal trading, inspired American shipbuilders to design the fast, slender naval craft used in the American Revolution. A development of the revolutionary period was the Baltimore clipper (q.v.), which established an international reputation for swiftness. In common use by 1790, the Baltimore clippers were usually rigged as schooners or brigs and were particularly successful in blockade running and privateering during the War of 1812. Slightly modified and increased in size to accommodate up to approximately 500 tons burden, they were used as fast mail and passenger packet ships in the transatlantic trade after the war.

The true clipper ships, which preceded the Baltimore clippers, were the highest development of the commercial sailing ship, combining speed and seaworthiness; see CLIPPER. The best known of the true clippers was the *Ann McKim*, built in Baltimore in 1832. The *Ann McKim*, like others of her type, such as *Bolivar*, built in New York in 1822, was comparatively long and slender, being 143 ft. in length and 31 ft. in beam. She was ship-rigged with three tall, raking masts and a characteristic extended raking stem at the forward end of her hull. The *Ann McKim* was



The English man-of-war Victory, built in the 18th century, was the flagship of Horatio Nelson.

built for the trade with China and was famous for the swiftness of her passages. Although widely publicized, the *Ann McKim* had little influence on the design of the later California clippers, which developed from the packet ships and were an overall result of accumulated knowledge about swift-vessel design.

Clippers were sailed not only in the China trade but also as immigrant vessels from Europe to the United States. They were highly successful in both trades and by about 1850 were acknowledged as the finest boats afloat. Added impetus was given to the American clipper builders by the California gold rush in 1849 and the repeal of the British navigation laws which forbade foreign ships to carry cargo between British-controlled ports. The gold rush created an immense passenger trade between the east coast of the U.S. and California by way of Cape Horn, and the lifting of the British embargo on foreign ships made it possible for American clippers to engage in the profitable tea trade.

The largest of all the clippers was the *Great Republic*, built in Massachusetts in 1853, which had a tonnage of more than 4500. In rig she was a four-masted barque, but this original rig was never used because the ship burned while loading for her first voyage, and when she was later salvaged the masts were cut down and the rig reduced to a smaller size. See also MCKAY, DONALD.

Close of the Sailing-Ship Era. American wooden ships, particularly the clippers, domi-

nated all ocean trade until the depression of 1857. At this time, however, the British took the lead in the construction of so-called composite ships, which were planked with wood over iron frames, and in the construction of iron ships. Ships of the composite type, such as the British *Cutty Sark*, carried a major portion of the ocean freight of the world until approximately 1900, but were unable to compete with steamships for the premium rates offered for fast freight service. In the Australian grain trade with Great Britain, sailing ships were used as late as the 1920's. These sailing ships were often made of steel and were usually rigged as barques, because this rig could be sailed with a smaller crew than the ship rig. For the American coastal trade many large schooners were constructed, and were used until the time of World War I and even afterward. These schooners had four or more masts, could carry large quantities of cargo because of their fore-and-aft rigs, and could be handled by a comparatively small number of men. The largest of these schooners was the seven-masted *Thomas W. Lawson*, built in 1902, which was a steel vessel with a tonnage of well over 5000. See SAIL; SAILING.

STEAMSHIPS

The earliest recorded use of steam power in a boat was in 1786, when the American inventor John Fitch (1743–98) propelled a small steam-boat on the Delaware R. He obtained a speed of

SHIPS AND SHIPBUILDING

more than 6 m.p.h. in his second steamboat, built in 1788. The American inventor Robert Fulton (q.v.) built his first successful paddle-wheel boat in 1807, and within a few years boats of this type were in extensive use on inland and coastal waters in both Great Britain and the U.S.

Early Developments. The first steam-powered vessel to cross the Atlantic Ocean was the converted coastal packet ship *Savannah*, which sailed from Savannah, Ga., on May 24, 1819, and reached Liverpool, England, on June 20. Various other boats subsequently made the Atlantic crossing, but regular service was not instituted until 1840, when the newly formed Cunard Line began and maintained regular service between Great Britain and the U.S. The ships used were wooden, paddle-wheel steamers which also carried masts and a barque rig for use when the wind was fair. Their speed under two engines with a total of about 1500 h.p. was 9 knots. The first U.S. steamers to maintain a regular schedule across the Atlantic were the *Hermann* and the *Washington*, which went into service in 1847. Among the early attempts to apply the screw-propeller principle to the propulsion of boats was the construction in 1804 by the American inventor John Stevens (q.v.) of a twin-screw, steam-powered boat. Although it had several successful trials, difficulties in manufacturing the engine discouraged him from further experimentation. Introduced independently in 1836 by the Swede John Ericsson (1803–89) and the Briton Francis Pettit Smith (1808–74), the

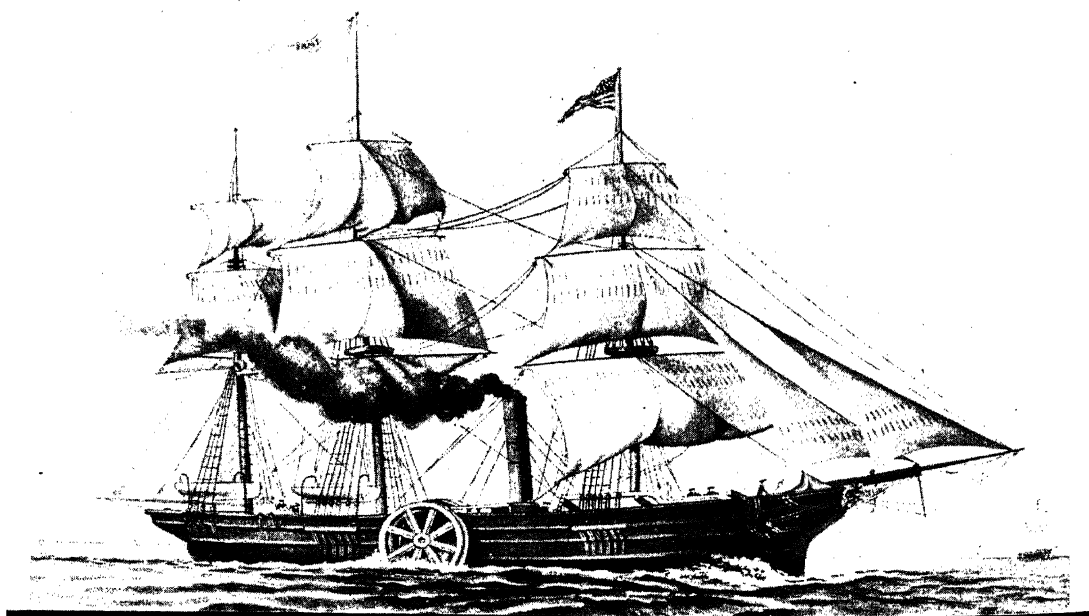
screw propeller was tried out in a number of vessels, notably the British vessel *Great Britain*, which was completed in 1844. She was 322 ft. in length and had a cargo capacity of almost 3500 tons. Her single engine of 2000 h.p. drove her at the rate of 12 knots. The success of the *Great Britain*, which was wrecked on the coast of Ireland but withstood severe winds and seas for an entire winter and was later refloated without damage, did much to remove the conservative prejudice against the use of iron as a shipbuilding material. See PROPELLER: *Ship Propellers*.

Evolution of Steamship Engines. Further improvements in the propulsive mechanism of steamships included the introduction of the multiple-expansion engine. Early marine steam engines employed the single-expansion principle in which steam from the boiler was introduced into the cylinders, in which it expanded and was then exhausted. With improvements in boilers and an increase in steam pressure, engine designers found that they could use the steam exhausted from one cylinder to power another low-pressure cylinder, thereby increasing the overall efficiency of the power plant. Engines of this type, known as double-expansion engines, were later supplanted by triple-expansion engines which were still more efficient. The first double-expansion engine was used in 1854 and the first triple-expansion engine in 1873. The use of engines of this type removed one of the great obstacles to the further development of the steamship: the need for carrying an extremely large supply of coal for fuel or for refueling frequently during long voyages.

Other developments included the introduc-

The Savannah, the first steam-powered vessel to cross the Atlantic Ocean, made the voyage in 29 days in 1819.

Bettmann Archive



tion of twin, and later triple and quadruple, screw propellers to minimize the danger of having a ship left helpless if a propeller or a propeller shaft broke. The first twin-screw ships were built in the early 1860's.

Beginning in the 1890's experiments were made in replacing reciprocating steam engines with steam turbines. The disadvantage of the turbine was that it was inherently a high-speed mechanism, but this was overcome by installing a reduction gear between the turbine and the propeller shaft, thereby permitting the turbine to drive the propeller at an efficient slow speed. Turbine installations are standard in most modern steamers and are sometimes combined with reciprocating engines which operate on the same shaft. In some of the more modern vessels, and particularly in warships, turboelectric drive systems have supplanted systems using mechanical drivers. A turboelectric power plant consists of a steam turbine driving a dynamo which, in turn, operates motors which turn the ship's propellers. Turboelectric drive is extremely flexible in operation and eliminates many of the mechanical difficulties of turning propellers through long heavy shafts.

By the late 1950's nuclear-power plants had been developed to provide steam for the propulsion of both naval and merchant ships. See NUCLEAR POWER; STEAM AND STEAM ENGINEERING: *Steam Turbines*.

MOTOR SHIPS

The development of the internal-combustion engine (q.v.) in the latter part of the 19th century, and particularly the development of diesel engines, made possible the design of power plants for ships that are far more efficient than any conventional steam plant. The use of efficient engines is of special importance in shipbuilding, because engines of high efficiency permit the ship to carry less fuel and more cargo. The first motor ships, the general term for ships using diesel power, were constructed in the early years of the 20th century; they were comparatively small, but in the years following World War I a number of large motor-powered passenger liners were built, and were operated with great success. Motor ships, according to a recent edition of *Lloyd's Register of Shipping*, make up 76 percent of the world fleet of more than 43,000 vessels of 100,000 tons and over; slightly less than 75 percent of the fleet is diesel-powered.

Surface-Effect, Captured Air-Bubble, and Hydrofoil Ships. In recent years a number of novel types of ships have been developed, all resulting from a constant search for faster trans-

portation. The conventional ship is a displacement vehicle; it goes through rather than over the water when moving, creating waves. Power is needed to overcome this wave-making effect and to overcome the friction between the skin of the ship and the water. At high speeds the power needed is enormous; for example, a 60,000-ton aircraft carrier must have 280,000 h.p. to drive it at 35 knots.

If a ship is lifted clear of the water, no waves are made and the ship is free of the frictional resistance of the water. Most recent shipbuilding developments try to free the vehicle from the surface of the water.

The surface-effect ship rides on an air cushion (see AIR-CUSHION VEHICLE). Air is pumped under the ship by large blowers. The ship is actually lifted by this cushion of air and rides on it instead of in water. Skirts extend down into the water to keep the air cushion intact. Wave-making is eliminated, and frictional resistance to the water is very small, so that it is possible to attain high over-water speeds with relatively small propulsive power. Ships of this type as large as 160 tons in weight have been built, and speeds higher than 100 knots have been reached. The true surface-effect ship is also capable of "flying" over smooth ground.

The captured-air-bubble ship is a variation of the surface-effect ship. It rides partially on air and partially in water. Air is pumped in at the bow and "captured" by a hinged skirt. As the ship moves through the water, part of the weight of the ship is supported by the bubble of air and the rest by water. This device helps to reduce both frictional and wave-making resistance and thus to increase the speed. The captured-air-bubble principle has been used successfully in small craft and is expected to be tested in a larger ship weighing about 100 tons.

The hydrokeel is somewhat similar to an air-supported ship. A relatively small fan is used to keep a thin sheet of air under the ship. The sheet of air acts as a lubricant and decreases the frictional resistance of the water. This principle has proved practical in small craft with flat bottoms, but no tests have so far been made with larger ships.

The hydrofoil ship operates on principles altogether different from the air-supported group. In these ships, foils are connected to the ship by struts and, working exactly like airplane wings, lift the hull from the water. As the ship increases its speed, it moves free of the water surface, supported by the underwater foils. The foils may be partly above and partly below the water surface; consequently, they are called surface-

SHIPS AND SHIPBUILDING

piercing foils. The faster the ship moves, the smaller the amount of foil is under water. The surface-piercing foil is the simplest kind of hydrofoil; it is extensively used on passenger boats and small ships plying the rivers and canals of Europe. The lifting foils may be entirely under water, in which case they are called submerged foils. The lift they provide is controlled by the angle of the foils and the speed of the ship. The United States Navy has executed plans to build a 300-ton submerged-foil ship. Speeds of 100 knots and more can be reached with hydrofoil ships.

SHIP STRUCTURE

Structurally, a ship is a hollow beam subjected to severe bending and twisting as it moves through waves and as its own load changes. The principles of structure of a ship and the nomenclature of its parts have long been established and are essentially the same whether the ship be a small wooden sailing ship or a large ocean liner. The backbone of all ships is the keel, a longitudinal beam or girder located at the very bottom of the vessel and extending from bow to stern. At the forward end of the keel is attached the upright or nearly upright stem which forms the front of the vessel. A similar sternpost is usually set at the after end of the keel. The ship is given its shape by a series of symmetrically curved ribs or frames which run transversely and which are fastened to the keel at their centers. At and near their centers on the bottom of the ship the frames are made considerably larger than at the sides and are known as floors. The ribs are held in position by longitudinal stringers, or clamps, which run the full length of the ship and which are curved to conform with the shape of the hull. Additional bracing is provided by beams extending across the width of the ship and fastened at either end to the opposite sides of the ribs. In very small vessels only one set of beams, set at the ends of the ribs, is used, and these beams serve as supports for the deck. In larger vessels, several series of beams are employed, the number corresponding to the number of decks with which the ship is provided.

The skin of the vessel is mounted outside of the frame. In steel vessels the skin consists of a number of metal plates riveted or welded to the frame, and in wooden vessels it consists of a number of horizontal planks called strakes. The term strakes is also sometimes applied to individual rows of steel plate in a metal hull. Transverse walls of wood or metal plate, depending upon the type of vessel, run from one side of the ship to the other at several places in

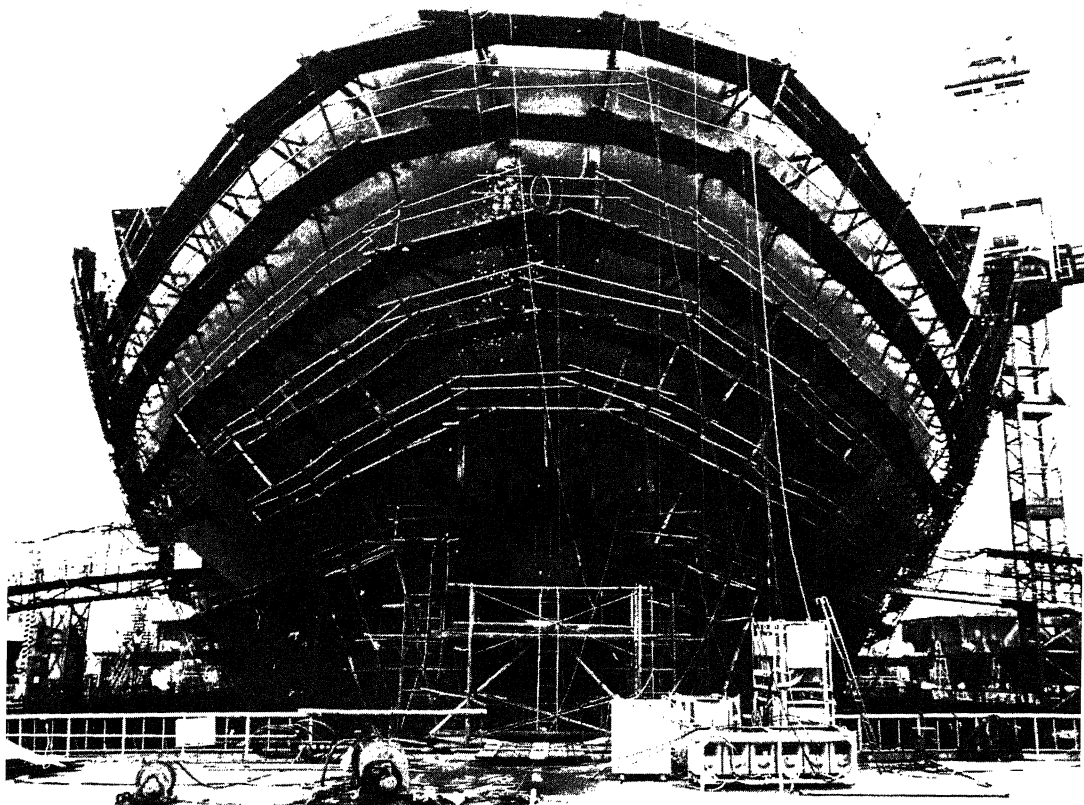
the length of the hull. These walls, called bulkheads, stiffen the frame and often are used to break the hull up into watertight compartments as a safety measure, so that a leak in the hull will flood only part of the ship and sufficient buoyancy will be maintained in the other compartments to keep the ship afloat.

A number of modifications of the standard method of ship framing have been devised, particularly for use in tankers, ships used for carrying petroleum products. Many tankers use a system of longitudinal framing in which a comparatively small number of large transverse frames is employed and the chief framing members are longitudinal and run the full length of the ship. The spacing of transverse frames in this method of ship construction is approximately 10 ft. instead of the 3 ft. used in conventional construction. The interior of tankers built on this system is divided into a number of compartments by a longitudinal bulkhead running the length of the ship at the centerline and by a number of transverse bulkheads. The longitudinal system of construction has been applied to other forms of cargo vessels as well as tankers.

SHIPBUILDING PRACTICE

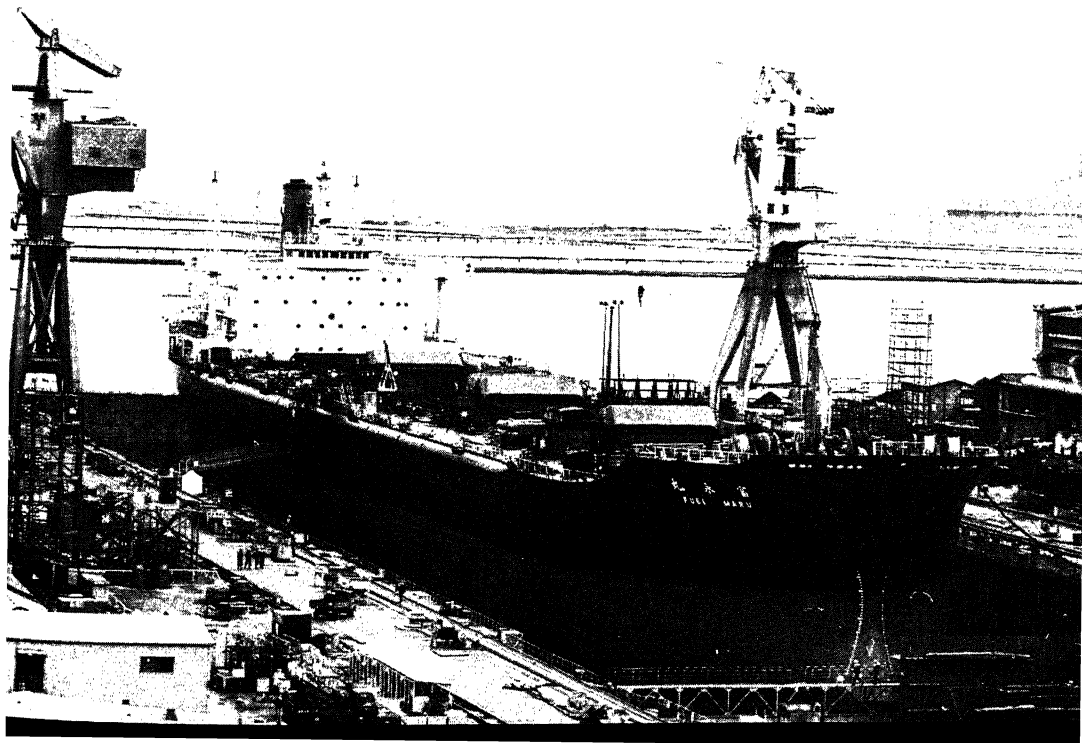
The actual construction of any type of ship whether made of wood or metal is complicated by the various curves of the hull, the compound angles formed by the joints between the various structural members, and the necessity of producing a hull that is absolutely symmetrical and "fair" (having regular curves and surfaces that are smooth). Because of these requirements, it is almost impossible to build any form of ship directly from small-scale plans, as is done in the case of other kinds of structures. Instead the shipbuilder must, before he commences his work, resort to the practice of lofting, or laying down, the lines of the ship. See NAVAL ARCHITECTURE.

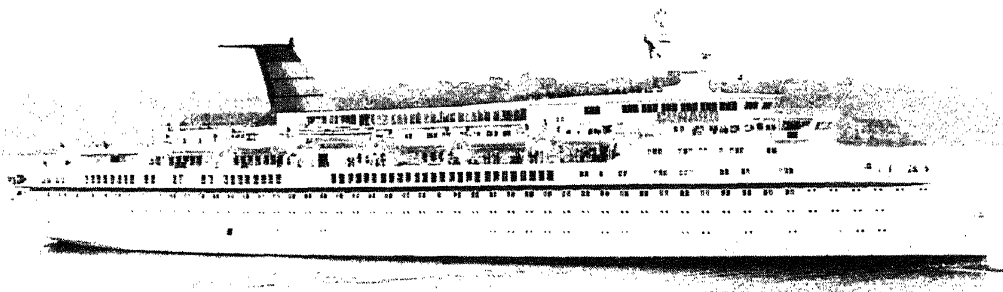
Lofting consists essentially of preparing in full size an exact skeleton plan of the hull to be built. From this plan the builder determines the dimensions and forms of the frames and plates, which, when assembled, make up the ship structure. The entire plan of the ship structure is laid down on the flat floor of a special room or building known as the mold loft. Paper or wooden patterns, called templates, of the pieces of the hull are then constructed from this plan and are used in the building shops to cut and form the plates and frames to the required configuration. The more complex the ship, the more detailed are the loft templates. Although the principles of lofting are unchanging, the specific techniques underwent rapid evo-



Japanese shipbuilding. Above: Protective scaffolding surrounds the stern section of a mammoth oil tanker under construction at a Japanese shipyard. Below: A nearly completed oil tanker rests in drydock as construction continues. Japan leads the world in shipbuilding and launches more oceangoing tonnage than all other countries combined.

UPI





A gleaming and graceful example of the sleek modern cruise ships of the 1970's: the Cunard Princess, which was launched in March, 1977.

Cunard Line

lution in the 1950's and early 1960's. The skeleton plan, instead of being laid down full size, is prepared with great precision to small scale, typically one tenth of full size. Templates are taken from this plan and photographed, resulting in transparencies less than $\frac{1}{100}$ th of full size. The transparencies are either projected onto the piece and the piece is marked off, or they are used directly by automatic cutting machines. For many parts of the hull, computers may be used to describe the shape of the part and the description may be used to control the cutting machine directly.

Building Wooden Ships. As mentioned above, the general structural details of wooden ships are the same as those of steel or iron ships, but the methods of construction differ somewhat because of the difference in the nature of the material.

The method of wooden shipbuilding called sawed-frame construction is essentially similar to the construction of steel ships. Wooden frames pieced together of a number of sawed pieces of wood are mounted on a heavy keel timber, are suitably braced, and are then covered with the hull planking. In bent-frame construction, the frames are set in place after the shape of the hull has been formed in the following manner. A number of heavy molds are set up at regular intervals along the keel, representing the cross section of the ship at those particular points. A number of comparatively light planks or strips of wood running in a longitudinal direction are then bent around the out-sides of the molds to form a kind of outer skeleton of the hull. These "ribbands" are then used as a form inside of which the wooden frames are bent into shape. The frame timbers are steamed or soaked in hot water until pliable and are then bent to fit the curves formed by the ribbands.

The outside of a wooden ship hull is finished

by planking which, like framing, is done by several different systems. In carvel planking the separate boards or strakes are laid edge to edge to form a smooth surface and the seams between them are calked to make them watertight. In lapstrake or clinker-built planking the boards of the hull are arranged so that the edge of each board slightly overlaps the one below it, like the siding of a clapboard house. In most forms of planking the boards run horizontally from the stem to the stern, but in hulls which are double-planked for extra strength it is common practice to run the planking of the inner skin on a diagonal and that of the outer skin horizontally.

Building Steel Ships. For many years the processes of ship construction were essentially the same throughout the world. The flat plate forming the keel was laid on blocks and a longitudinal girder was attached along its centerline. This girder serves to make a space between the outer shell of the ship and the inner plating of the hold, thus providing a double bottom that adds strength and serves as a storage tank for fuel oil or for water used as ballast to trim the ship. The plates and beams that form the individual frames were then cut and bent to shape according to the mold-loft templates. The frames extended from either side of the keel and vertical girder to the top of the sides or the gunwales of the ship. The deck beams that reach from gunwale to gunwale and hold the tops of the frames together were erected, and the steel plating that covers the sides and decks was fastened in place. Then the inner structural members of the hull were set in place and fastened.

In recent years major changes in shipbuilding processes have been made possible by welding

instead of riveting parts together and by using cranes that can lift, transfer, and place very heavy weights, as much as 800 tons. The parts of the ship remain the same, but they are assembled into large subsections or blocks in the shop, not on the ways. The size of the sections is determined according to the best use of shipyard equipment. Often they are built upside down to facilitate the fastening of the parts together. Often the machinery and piping for each subsection are fitted in place during shop assembly. The blocks are then moved to the erection ways or the erection dock and fitted together. Thus, much of the work on the ship can be done before moving it to the building ways.

The ship may be assembled on building ways or in a dock. In the latter case, when the hull is completed, the dock is flooded and the ship floated out. Docks are used in the assembly of all very large ships. Most other ships are assembled on building ways. The ways are on ground above the edge of the water and slant toward the water. When the ways are at right angles to the edge of the water, the ship is "end-launched". When the water is narrow, the ways may be parallel to it; in that case the ship is "side-launched". The ways consist of two sets of heavy timbers: the fixed ways, which extend on either side of the ship from the point of building to below the high-water mark, and the movable ways, which slide on the fixed ways and support the weight of the ship by means of an elaborate wooden cradle. When the ship is ready for launching, the cradle is set in position, the keel blocks used during building are removed, and the surfaces of both the fixed and movable ways are heavily lubricated with tallow, soap, or grease. The fixed and movable ways are also firmly fastened together so that the ship will not move on the ways until the moment for launching arrives. At that time the spikes or other fastenings holding the ways are released and the ship slides down into the water of its own weight. The construction of ways and the launching of ships, particularly large ones, are precise and delicate operations. After the ship has been launched, its construction is finished while it is moored at a pier. The final processes before launching depend on the extent to which the ship is completed; a ship can be complete in all respects except testing before it is launched. Usually, however, after launching, the final equipment is installed, the equipment is tested, and the ship is delivered to the owner.

See also NAVAL ARCHITECTURE.

SHIPBUILDING STATISTICS

In 1978, 3382 ships of at least 100 gross tons were on order or being built throughout the world. Japan was building 26 percent of these ships. After Japan, in order of percentage of world construction, were the U.S., Brazil, Sweden, and Great Britain. The U.S. had 233 merchant ships on order or under construction. The value of work performed by U.S. private shipyards was about \$5.5 billion in the mid-1970's; 232,000 people were employed annually.

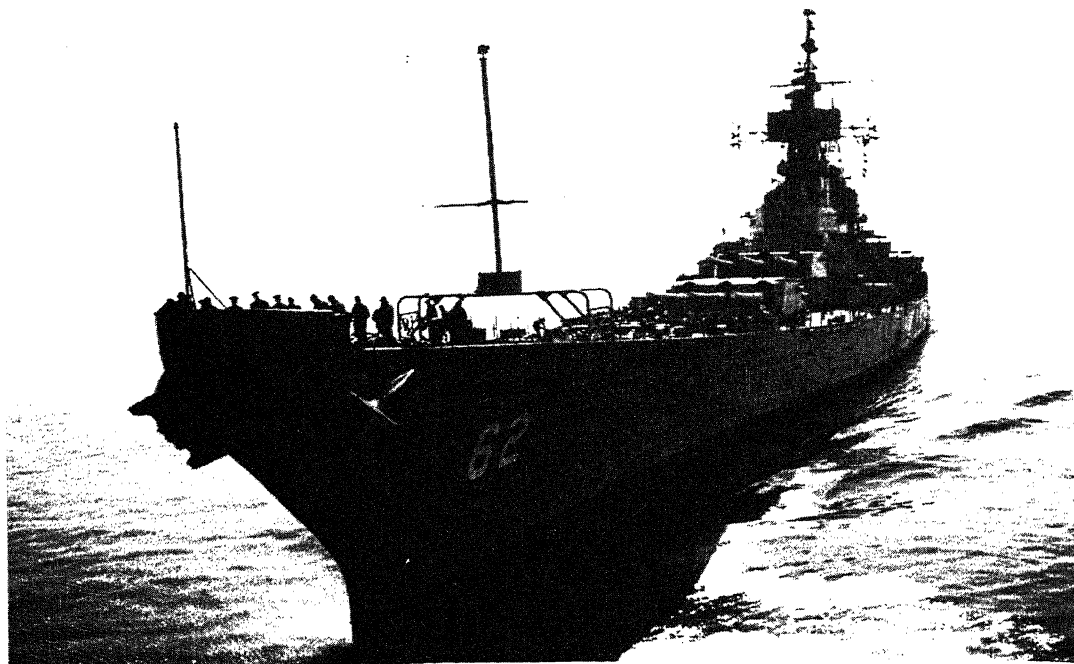
H.I.C.

SHIP'S CLOCK, or **SHIP'S BELL,** clock that chimes on the half hour in order to indicate time to the men on watch aboard vessels. At the end of each half hour of watch, an additional note is sounded, until eight notes are finally struck. This sequence of notes is repeated during each of the six four-hour watches.

SHIPS, NAVAL, vessels designed for the various operations involved in modern naval seafaring and combat. The following survey is concerned only with the principal classes of United States naval vessels, which may be regarded as typical of those maintained by most naval powers with the exception of submarines and aircraft carriers described in separate articles.

Battleship. The United States Navy (q.v.) officially defines the battleship as the ship with the greatest offensive and defensive power. The modern battleship is the product of a series of modifications of the heavy steel ship that formed the backbone of the so-called New Navy of 1883. The steel battleship replaced the seventy-four-gun ship of the sailing navy.

The mission of the battleship is threefold: to engage and sink enemy ships by long-range gunfire; to support fast carrier task forces; and to bombard and destroy enemy harbor and shore installations, often before and during the initial phases of amphibious landings. The sides, superstructure, and deck of a battleship are made of steel armor varying in thickness from 5 to 16 in. A typical modern battleship is 887 ft. long, has a beam of 108 ft., displaces about 59,300 tons, and attains a speed of 31 knots. It is armed with nine 16-in. guns arranged in three triple turrets; twenty twin-mounted 5-in. guns; and thirty 3-in. guns. A crew of 2000 officers and men is normally necessary to man a battleship engaged in active warfare, although the World War II (q.v.) complement totaled 6000 officers and men. During part of the Vietnam conflict, the U.S. Navy had one battleship, the *New Jersey*, in active service. Because of its high missile capability, the primary mission of this battleship was enemy shore bombardment and antiaircraft



The U.S.S. New Jersey, a World War II battleship.

U.S. Navy

defense; see **ANTI-AIRCRAFT WEAPONS**; **GUIDED MISSILES**.

Cruiser. The cruiser, formerly a flagship, replaced the fast frigate (see *Frigate*, below) of the early U.S. Navy for commerce, raiding, fleet scouting, communications control, screening, anti-aircraft defense, guarding or escorting of aircraft carriers, and support for amphibious landings. The types of cruiser in service are the large cruiser, heavy cruiser, light cruiser, command ship, and nuclear-powered guided-missile cruiser. The 8-in., 5-in., 40-mm, and 20-mm gun mounts have been replaced, primarily by Terrier and Tartar missile launchers and their directors, and also by torpedo (q.v.) tubes and advanced antisubmarine weapons.

LARGE CRUISER. The large cruiser, a now obsolete, World War II vessel, had a length of 808 ft. and a beam of 91 ft., displaced 27,500 tons, and cruised at speeds of more than 33 knots. The full crew of such a vessel comprised 2300 officers and men.

HEAVY CRUISER. The length of a heavy cruiser ranges from 588 to 716 ft.; the beam is from 62 to 76 ft., and is capable of speeds up to 33 knots. The armor is 3 to 6 in. thick. The heavy cruiser displaces from 9950 to 17,200 tons and is manned by 1000 to 2000 officers and men.

LIGHT CRUISER. The light cruiser is manned by 800 to 1400 officers and men. It is capable of speeds in excess of 33 knots. It measures 541 to 679 ft. in length, has a beam ranging from 53 to 70 ft., and displaces from 6000 to 14,700 tons.

NUCLEAR-POWERED GUIDED-MISSILE CRUISER. The nuclear-powered guided-missile cruiser is the first new type of cruiser designed after World War II. The prototype of this cruiser, which was completed in 1959, is armed almost entirely with guided missiles, displaces 16,250 tons, has a length of 700 ft. and a beam of 75 ft., and is propelled by nuclear energy. It attains a speed of more than 30 knots and is manned by a crew of 1700 officers and men. See **NUCLEAR ENERGY: Nuclear Propulsion**; **NUCLEAR POWER: Propulsion Reactors**.

Destroyer. The destroyer is a light, fast, hard-hitting ship that serves a great variety of functions because of its speed and armament. It replaced the sloop of war (see **SLOOP**) of the sailing navy, and evolved from the torpedo-boat destroyer designed to combat the torpedo boat; see **PT BOAT**. After the introduction of the submarine into naval warfare the destroyer, with electronic underwater detection devices, was used also for locating and destroying enemy undersea vessels; see **SONAR**. Destroyers also serve as protective screens against enemy submarines, as radar picket ships, as airplane guardians for carriers, as smoke-screen layers, as anti-aircraft screens, as escort ships for convoys, and as support ships for amphibious landings. Destroyers in World War II were armed with three single or twin 5-in. guns, four to eight 3-in. guns, and ten to twelve 40-mm guns. Their antisubmarine weapons were limited to depth charges (see **DEPTH CHARGE**), torpedo tubes, and so-called searchlight sonar. Beginning in the late 1950's, they were equipped with missile and electronic

installations, rocket-powered weapons (see **ROCKET**) and larger sonars. The destroyer guns consequently became secondary armaments.

Destroyers displace from 1620 to 2850 tons, measure from 348 to 486 ft. in length and 36 to 45 ft. in beam, range in speed from 31 to 34 knots, and are manned by 200 to 350 officers and men.

Destroyer subtypes serving distinct purposes include the corvette and the escort destroyer, which are outfitted with special antisubmarine equipment necessary to protect large convoys at sea; and the guided-missile destroyer, which is armed with surface-to-air missiles and is best suited to antiaircraft and antimissile warfare.

FRIGATE. The frigate, the guided-missile frigate, and the nuclear-powered frigate are classified as destroyers. These types differ, however, from the standard destroyer in many respects. The frigate was designed as a special category of antisubmarine vessel. It is built on a cruiser hull and has a stability and seaworthiness allowing it to engage in submarine-hunting operations even in the worst weather. Equipped with the most modern electronic equipment, including radar (q.v.) and sonar, it is especially suitable as a flagship for destroyer screens attached to fast carrier task forces. The frigate is 535 ft. in length, has a beam of 53 ft., displaces 5000 tons, cruises at 34 knots, and is manned by about 400 officers and men. The guided-missile frigate is armed with guided missiles. The first nuclear-powered frigate was commissioned in 1962.

Amphibious-Warfare Ships. Amphibious-warfare ships include all types of vessels designed especially to serve specific functions during amphibious operations in warfare. Most of these types were developed during World War II in

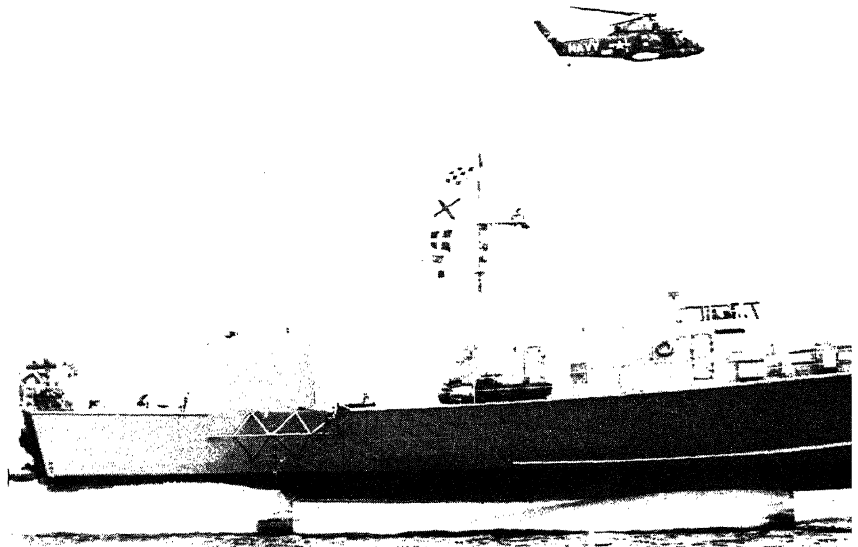
connection with the island-to-island campaigns in the Pacific Ocean and with the invasions of Europe. The first amphibious vessel was built in 1942. This was the landing ship tank, or LST designed primarily for transporting heavy tanks; see **TANK**. The ability of the LST to carry a wide variety of vehicles, bulldozers, road-building equipment, artillery (q.v.) pieces, and general cargo led to the development of specialized types. Among amphibious-warfare ships are the amphibious-force flagship, which serves as the nerve center of an amphibious operation; the attack cargo ship, the attack transport, and the high-speed transport, all of which carry landing craft capable of unloading cargo and personnel on an enemy beach; the medium landing ship, the tank landing ship, and the large infantry landing ship, all capable of delivering their men and cargo to the beach; the rocket-firing in-shore fire-support ship; and the dock-landing ship, which can accommodate for repairs in its well deck a vessel as large as a medium landing ship.

Since World War II, floating ambulances, aircraft tenders and repair ships, salvage craft, and general-stores issue ships have been built. The most recent ships of this type are modernized versions having not only increased cargo and troop capacity but also permanent flight decks for the use of assault transport helicopters during invasions; see **HELICOPTER**.

Mine-Warfare Vessels. Mine-warfare vessels include both mine layers and mine sweepers; see **MINE**. These craft range in size from small yachts to destroyers and merchant vessels converted for this particular purpose. The larger mine layers, capable of carrying some 800 mines, are equipped with specialized mine-

The Navy hydrofoil craft U.S.S. High Point is propelled by gas turbine engines and is capable of speeds up to 40 knots.

U.S. Navy



SHIPS, NAVAL

handling equipment. Mine sweepers differ in size and construction according to their purposes. Modern ocean going and coastal mine sweepers are constructed often of wood and nonmagnetic metals to reduce the possibility of attracting magnetic mines while sweeping. The hulls of the latest minecraft vessels and patrol boats are made of glass-reinforced plastic.

Patrol Vessels. Patrol vessels include all ships used primarily for patrol and escort duties. The largest type of patrol vessel is the escort vessel familiarly known as the D.E. The escort vessel is armed with four 3-in. guns, depth charges, and two fixed torpedo tubes. The most modern type of escort vessel is approximately 315 ft. in length and 36 ft. in beam, displaces 1450 tons, can cruise at 25 knots, and is manned by about 150 officers and men. Many ships of this type were converted into radar picket ships. Other types of patrol vessels include submarine chasers, rescue escort vessels, patrol escort vessels, and PT boats; see PT BOAT.

Auxiliary Vessels. Auxiliary vessels include numerous types designed especially to repair or to replenish combatant ships. These types enable the fleet to remain at sea and in combat areas for extended periods of time. Important types are destroyer, submarine, and airplane tenders, capable of making repairs not requiring the extensive facilities of a naval shipyard, of supplying spare parts and ammunition, and of rendering medical and dental care to shipboard personnel. Another important type includes the ship and aircraft repair ships which are outfitted to repair specific equipment, such as boilers, turbines, and guns. Among other types of auxiliary vessels are ammunition ships; radar picket ships; store ships, used to replenish ship food supplies; icebreakers (see ICEBREAKER); hospital ships; cargo ships; general-stores issue ships, which carry provisions other than food; net-laying ships; oilers; gasoline tankers; salvage ships; tugs; aviation supply ships; water-distilling ships; utility aircraft carriers; and auxiliary and oiler submarines. Modern replenishment ships are outfitted to transfer cargo at sea while both vessels are underway. Small flight decks built on the ships enable supplies to be transferred by helicopter, if necessary. These ships are a combination of seagoing service stations and supermarkets.

Range Instrument Ships. The advent of the U.S. space program in the late 1950's required a new family of vessels to augment fixed land stations to track, communicate with, and also control spacecraft and space satellites; see ASTRONAUTICS; SATELLITES, ARTIFICIAL. These ships carry

complex telemetering equipment; see TELEMETRY.

In addition to these types, the U.S. Navy has a large number of other service craft, each with a specific mission, such as floating dry docks, barracks ships, motor-torpedo boats, lighters, dredges, fuel-oil, water, and gasoline barges, and harbor tugs. Hydrofoil (q.v.) vessels are used as patrol craft for antisubmarine warfare, and as gunboats and amphibians.

New types of naval ships are developed and existing types are modified on the basis of technological developments. Among them are the air-cushion vehicle (q.v.), oceangoing salvage tugs, submarine rescue ships, and oceanographic research and surveying vessels (see OCEAN AND OCEANOGRAPHY). Changes in armament since World War II include the gradual replacement of the 40-mm antiaircraft gun by longer-range, radar-controlled 3-in. guns on all active combatant ships; the removal of 20-mm antiaircraft machine guns from these vessels; and the substitution of guided missiles for a number of the rifled guns on many cruisers, destroyers, and submarines. The war in Vietnam reversed this trend to a certain extent, and ships deemed obsolete because their guns were of World War II and Korean War vintage were recalled to active service because of their ability to bombard shore targets while lying far offshore. The introduction of nuclear propulsion greatly increased the cruising radius of naval vessels, making them more independent than formerly and consequently more potent weapons.

See also CONVOY; MERCHANT MARINE OF THE UNITED STATES; SHIPPING; SHIPS AND SHIPBUILDING.

H.A.V.

SHIPWORM, or **TEREDO**, much modified boring clam of the family Teredinidae, so called from being wormlike in general shape and from boring into hulls below their waterline. The animal ranges from several inches to 3 ft. in length. The shell itself is much reduced, equi-oval, widely gaping, and covers only a part of the animal. The shipworm is a menace to wooden ships and piers.

SHIRAZ, city and port in Iran, and capital of Fars Province, on the Persian Gulf, 115 miles N.E. of Bushire. Shiraz is the commercial center of the surrounding region, which produces grapes, citrus fruit, cotton, and rice. In addition to Shiraz wine, which has been famed for centuries, the chief products of the city are inlaid articles of wood, metalwork and silverwork, rugs, brocades and other textiles, cement, and fertilizer. Points of interest in Shiraz include the tombs of the celebrated Persian poets Hafiz and Saadi

(q.v.), both natives of the city, and the 9th-century mosque of Masjid-i-Jama. The city is also the site of Pahlavi University (1945). Shiraz was founded in the 7th century and was the capital of Persia (now Iran) several times. Pop. (1973 est.) 280,000.

SHIRLEY, James (1596–1666), English dramatist, born in London, and educated at the University of Cambridge. He was a schoolmaster from 1623 until the success of his first play in 1625. His output until 1642, when the Puritan suppression of stage plays ended his career, came to about forty plays. They are considered a link between Renaissance drama and Restoration drama; see *DRAMA: National Drama: England*. Shirley's best works are his comedies, which are noted for their fantasy and clever satire. They include *The Witty Fair One* (1628) and *The Lady of Pleasure* (1635).

SHIRLEY, William (1674–1771), British governor and soldier in America, born in Sussex, England. He was educated at the University of Cambridge and became a lawyer. In 1731 he came to Boston, Mass., and became an upholder of British colonial interests in America. Ten years later he was appointed governor of the colony, serving until 1756, when he was removed from office after he led an unsuccessful attack on Fort Niagara during the French and Indian War (q.v.). Shirley's greatest accomplishments were his plan that led to the capture of the French fortress of Louisbourg in 1745, during King George's War (q.v.), and his stabilizing of the economy in Massachusetts. In 1761 he was appointed governor of the Bahamas, a post from which he retired the year before his death.

SHIZUOKA, city in Japan, and capital of Shizuoka Prefecture, on the island of Honshu, on Suruga Bay, 90 miles s.w. of Tokyo. Products of the city include processed tea and oranges, plywood, and lacquer ware. In the city are Shizuoka University (1949) and the Hodai-in Buddhist Temple. In 1936 the town of Hikuma was incorporated into Shizuoka. Pop. (1970) 416,378.

SHKODËR or **SHKODRA**, or **SCUTARI**, city of Albania, at the confluence of the Bojana (Buenë) and Drin rivers, 55 miles n.w. of Tiranë. Shkodër is a trading and industrial center of northern Albania. The manufactures of the city include tobacco products, textiles, cement, leather products, and building materials. The city is dominated by a 15th-century Venetian citadel built on a hill. The ancient capital of Illyria (q.v.), Shkodër fell to the Romans in 168 B.C. The Serbians captured the town in the 7th century; in the 14th century it was sold to the Venetians. The Ottoman Turks captured the city in

the next century and held it until 1913, when it was captured by the Montenegrins during the Balkan Wars (q.v.). An international force occupied the city in the same year, and shortly thereafter it became part of the newly independent kingdom of Albania. Pop. (1970 est.) 55,000.

SHOA, province of central Ethiopia, formerly the Kingdom of Shoa. The population is comprised mainly of Amharas (see *AMHARIC LANGUAGE*) and Galla (q.v.), and the predominant religion is Christianity. Coffee, vegetables, tobacco, cereals, and bananas are the principal products of the province. The capital is Addis Ababa, which is also the capital of Ethiopia. The Kingdom of Shoa was united with the rest of the country in 1889 when the king of Shoa, Menelik II (q.v.), became king of all Ethiopia. See *ETHIOPIA: History*. Pop. (1971 est.) 5,050,000.

SHOCK, in physiology, state of acute circulatory insufficiency of the blood (q.v.). It is the result of the inability of the heart (q.v.) to pump an adequate volume of blood at sufficient pressure for normal blood perfusion through the major organs of the body; see *CIRCULATION OF THE BLOOD*. Shock may be caused by injury, burns, hemorrhage (see *BLEEDING*), or major surgery (q.v.). Sudden infection or poisoning and abnormal extracellular fluid volume resulting from excessive loss of water and electrolytes (ionic conductors) from the gastrointestinal tract, kidneys, or skin may also cause shock.

Shock is generally characterized by apathy, weakness, shallow breathing, rapid heartbeat, feeble pulse, lowered blood pressure, and coldness and clamminess of skin. During the early stage consciousness is retained, but alertness is diminished. Sudden peripheral circulatory failure, however, affects the brain and fainting occurs after a brief interval. In less severe shock compensatory constriction of the blood vessels helps restore circulation, but if shock persists, compensatory mechanisms fail and local anemia (q.v.) damages vital organs, such as the brain, heart, liver, and lungs.

Initial treatment for shock involves keeping the patient warm, administering oxygen and sedation, and reducing abnormally high body temperature. Plasma or whole-blood transfusion increases the volume of blood in circulation, thus raising blood pressure and ensuring adequate distribution of blood. Plasma substitutes or plasma-volume expanders are sometimes more effective than whole blood. Once shock is under control, intravenous glucose solutions are administered to compensate for water loss caused by shock. Potassium chloride should also be administered unless the output of urine

SHOCKLEY

is diminished. Vasopressor drugs that constrict blood vessels are helpful in raising blood pressure. Steroid hormones (q.v.) are usually administered in cases of severe shock.

A particularly intense form of shock, known as anaphylactic shock, in which blood vessels relax, and the blood collects in the tissues, results from body sensitization to certain proteins (see **PROTEIN**), such as bee venom or hypersensitivity to drugs such as penicillin (q.v.). The effects of shock range from a minor, almost unrecognizable, discomfort, to so-called irreversible shock, resulting in lung complications and heart attack. Rapid diagnosis and immediate treatment are of vital importance.

See **also** **FIRST AID**.

SHOCKLEY, William Bradford (1910–), American physicist, born in London, England, and educated at the California Institute of Technology and the Massachusetts Institute of Technology. He was with Bell Telephone Laboratories from 1936 to 1956, when he became director of the Shockley Transistor Corporation in Palo Alto, Calif. He lectured at Stanford University from 1958 and became professor of engineering science in 1963. His research on semiconductors led to the development of the transistor (q.v.), a tiny device used to amplify or rectify current in electronic systems. For this research he shared the 1956 Nobel Prize in physics with his associates John Bardeen and Walter H. Brattain (qq.v.). After 1959 he served on the Air Force Scientific Advisory Board.

SHOCK THERAPY. See **MENTAL DISORDERS: Psychoses: Manic-Depressive Psychosis**; **PSYCHIATRY: Treatment**.

SHOEBILL, tall marsh bird, *Balaeniceps rex*, of the Shoebill family Balaenicipitidae, found in Africa in swamps along the White Nile R. Also known as the whale-headed stork and the shoe-bird, it stands about 4 ft. high on long legs and is gray and greenish in color; the wings and tail are blackish. It is named for its large, blunt bill, up to 8 in. long and almost as wide, which it opens and closes rapidly with a rattling sound when disturbed. Shoebills live in pairs and wade in shallow waters, feeding on small fish, frogs, turtles, and young alligators; and also on lungfish and garfish, which they dig out of mud with their bill. The shoebill nests in trees in grass-lined platforms of reeds. In flight it holds its neck in the shape of an "s".

SHOEMAKER, William Lee (1931–), American jockey, born in Fabens, Texas. Shoemaker left school at fifteen and won his first horse race at nineteen. Between 1949 and 1976, despite a leg injury he suffered in 1967 that forced him to

retire for more than a year, Shoemaker rode in over 29,000 races. In 1953 he established a record of 485 victories in one year, and in 1970 he set a lifetime record of 6027 victories. In 1976 he passed the 7000 mark. For seven consecutive years (1958–64) Shoemaker, known as Willie the Shoe to racing fans, was the leading money winner among jockeys. He is regarded by many as the best jockey in the history of horse racing. **SHOES.** See **BOOTS AND SHOES**.

SHOFAR or **SHOPHAR**, musical instrument developed by the ancient Hebrews (q.v.) and consisting of an antelope's or ram's horn, with the smaller end flattened to form a mouthpiece. The shofar normally can produce only two tones, corresponding roughly to the first and second harmonics basic tone; thus, as a musical instrument, it is very limited; see **HARMONICS: TONE**. In ancient times it was used as a signaling instrument in various cultic ceremonies and rituals, most notably in religious rites conducted in the Temple (see **TEMPLE: Temple at Jerusalem**). The shofar is still used by Jews (q.v.) in the rituals celebrating Rosh Hashanah and Yom Kippur (qq.v.). See **also** **PRAYER, JEWISH**.

SHOGUN, title for the ruler of Japan from 1192 to 1867. See **JAPAN: History: Early Shoguns (12th–16th Centuries)**; *The Tokugawa Shogunate (1603–1867)*.

SHOLAPUR, city of the Republic of India, in Maharashtra State, about 175 miles n.w. of Hyderabad. A textile-manufacturing center, Sholapur is also the market city for the surrounding agricultural region. In Sholapur are plants producing carpets, chemicals, leather goods, and metal products. Points of interest include a Muslim fort dating from the 14th century. Under the rule of the Moguls after 1668, Sholapur passed to the Marathas (q.v.) in 1795, and in 1818 to the British. Pop. (1971) 398,122.

SHOLOKHOV, Mikhail Aleksandrovich (1905–), Soviet novelist, born in Veshenskaya, a village in the lower region of the Don River in the Russian S.F.S.R. His major writings realistically and dramatically depict the lives of the people of this region. They include the novels *The Silent Don* (4 vol., 1928–40), which was published in two volumes in English, *And Quiet Flows the Don* (1934) and *The Don Flows Home to the Sea* (1940); and *Virgin Soil Uplturned* (2 vol., 1932–60), the first volume published (1935) in England as *Virgin Soil Uplturned* and in the United States as *Seeds of Tomorrow*, and the second volume translated as *Harvest on the Don* (1960). Sholokhov is also the author of *They Fought for Their Fatherland*, a projected trilogy inspired by World War II; the first volume was published

in 1959. He received the Stalin Prize in 1941, the Order of Lenin in 1955, and the Lenin Prize in 1960. He was awarded the 1965 Nobel Prize in literature as one of the outstanding writers of our time.

SHOOTING. See GAME AND GAME LAWS; TARGET SHOOTING; TRAPSHOOTING AND SKEET SHOOTING.

SHOOTING STAR, or FALLING STAR, in astronomy, common name applied to a meteor (q.v.) because of its rapid progress through the sky.

SHOPHAR. See SHOFAR.

SHORTHAND, any system of writing sufficiently brief to enable a writer to keep pace with normal human utterance. A shorthand script usually differs from longhand by providing a single stroke, either straight or curved, to represent each distinct sound in the language and by the omission of silent letters. See also PHONETICS; WRITING.

The various systems are usually separated into the following divisions: (a) the alphabet, including characters for the representation of consonants, vowels, and diphthongs; (b) expedients, making use of auxiliary material such as compound strokes or combinations of strokes of varying lengths and thicknesses to secure a maximum of brevity; (c) abbreviating principles whereby a syllable or the most suggestive part of a word may be substituted for the complete outline; and (d) the union of two or more words in one mark or outline, technically known as phrasing. The hand of the average trained shorthand writer is capable of executing from 400 to 500 motions per min. By dividing this number by the rate of speed desired, the number of motions which may be allotted to each word is determined. Most present-day systems can meet the demands of legibility with an average of from two to three motions per word.

HISTORY

The art of shorthand flourished extensively throughout the Roman Empire during the 1st century B.C. and continued to be practiced for at least 400 years afterward. Shorthand in Roman times was used chiefly by the leaders in the church and by the officials of the government. The official titles used were *notarii* for those who took dictation, *librarii* for those who transcribed notes, and *exceptores* for functionaries attached to the civil officers of the government.

Modern shorthand dates from the late 16th century, and its history is largely the achievement of Englishmen. In 1588 the English cleric Timothy Bright (1551?–1615) produced a system to which he gave the title *Characterie; the Art of Short, Swift, and Secret Writing, by Character*.

Printed at London, with the Privilege of the Queen, Forbidding All Others to Print the Same. For this work Bright is generally acknowledged to be the inventor of modern shorthand. Fourteen years afterward, alphabetic shorthand made its appearance when the stenographer John Willis (d. 1628?) in 1602 gave to the world his work, entitled *The Art of Stenographie, or Short Writing by Spelling Characterie*. This system was the foundation for all subsequent ones. In 1642 the dramatist William Cartwright (1611?–43) produced a system which marked a further advance, producing a work called *Semography*. In 1707 the stenographer and writing master William Mason (1672–1709) produced his work on shorthand, entitled *La Plume Volante, or the Art of Shorthand Improv'd*. The poet and hymn writer John Byrom (1692–1763) during his lifetime contributed greatly to the development of shorthand by improving the systems then extant. The stenographer Samuel Taylor (1749–1811) was the next Englishman to contribute to the development of shorthand. His work, entitled *An Essay Intended to Establish a Standard for a Universal System of Stenography*, made its appearance in 1786. The Taylor system rapidly found its way to the Continent and was adapted to practically all of the European languages.

Pitman Shorthand. The next landmark in the development of the art is the system of the English phonographer Sir Isaac Pitman (q.v.), who devised a number of shorthand systems. In 1837 Pitman, a student of the Taylor system and only twenty-four years old, published his *Stenographic Sound Hand*. This was followed in 1840 by his *System of Phonography*. Distinctive features claimed for this new system, which was essentially phonetic, were (a) a sign for each sound, including the vowels; (b) light and heavy strokes for the paired sounds; (c) no compound or modified strokes; and (d) the joining of little words together—phrasing. Provision was made in Pitman's first edition for the representation of the liquids *l* and *r* by hooks. The halving principle, whereby a stem is shortened to represent the letters *t* or *d*, was introduced in the second edition (1840). Joined words, contractions, and phrases appeared in the fifth edition (1842). The representation of the letter *n* by means of a hook was given in Pitman's sixth edition (1844). Final hooks for *f*, *v*, and the phonetic termination *shun* were published in the tenth edition of 1857, and other modifications and improvements were made in subsequent editions. The Pitman system was introduced in the United States in the 1840's.

The fundamental features of all the Pitmanic

SHORTHAND

systems are quite similar, so that a description of one will answer for all. A fundamental feature of Pitman is the median or positional line. Implicit in the interpretation of all vertical and horizontal strokes is their relation to this basic line, and for this reason Pitman shorthand always requires lined paper. The consonant alphabet is derived from the circumference and radii of the circle. The system has twenty-six characters representing twenty-four sounds. Duplicate or alternate characters are provided for *r* and *h*. Twelve vowel sounds are represented by dots and dashes; long vowels are represented by heavy characters and short vowels

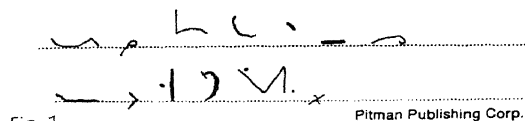


Fig. 1

Pitman Publishing Corp.

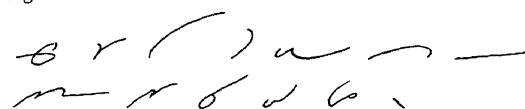


Fig. 2

Gregg Publishing Div., McGraw-Hill Book Co.

Examples of modern shorthand. "Now is the time for all good men to come to the aid of their party," written in the Pitman (1) and Gregg (2) systems.

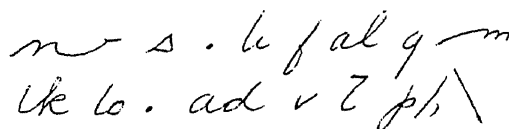
by light characters. The consonants are written first, and then the vowel is placed in its proper position. Vowels placed to the left of a vertical stroke, or above a horizontal stroke, are read before; when placed to the right of a vertical stroke or below a horizontal stroke, they are read after the stem. The diphthongs are represented by acute angles pointed in various directions. The sound of *u* is represented by a semi-circle opening downward. Silent letters are omitted. The letter *s*, the mark for which is a curve or arc, occurs more frequently at the beginning or end of syllables than any other consonant. The circle, the most distinctive auxiliary material in Pitman, is used as a duplicate form of this letter. The circle is lengthened slightly to indicate a following *t*, and is made twice its usual size to represent *sw* at the beginning of words and *ses* at the end of syllables.

Hooks on strokes are an important part of the Pitman system. A small hook placed at the beginning of a stroke represents *l* or *r*, depending upon which side it is written. Likewise a small hook at the end of a stroke represents *n*, *f*, or *v*, depending upon the side it is written. A large final hook represents the phonetic termination *shun*. By making a stroke half its usual length, the sound of either *t* or *d* is indicated. Doubling

the length of a stroke indicates the sound of *ter*, *der*, and *ther*. For certain common words, the most representative sound in a word is used to designate the word itself, as in the cases of *a*, *an*, and *the*, and the prepositions *of* and *on*. Words having these brief signs are called *gramalogues*. For long words, called *contractions*, two strokes are employed. Where two or more words are joined in one outline, they are called *phrases*.

Gregg Shorthand. The system of shorthand invented by the Irish stenographer John Robert Gregg (q.v.), which now bears his name, was first published in Liverpool, England, in 1888, under the title *Light Line Phonography, the Phonetic Hand Writing*. The system was introduced in the U.S. in 1893 in the city of Boston by the author. The Gregg system is radically different from the geometric style, the characters being based upon the movement used in longhand writing. The characteristic features are: (a) the absence of the shading or thickening principle; (b) a uniform motion of the hand, resulting from the fact that the characters are similar to the strokes used in longhand; (c) the insertion of the vowels without the necessity of lifting the pen, or writing the outline above, on, or through the line to indicate them; (d) uniform lineality, or consecutive sense, by reason of the nature of the alphabetic strokes; (e) facility of execution by reason of the predominance of curved strokes; (f) individuality of form, there being few outlines which are not distinctive; and (g) the systematic blending of frequent consonant combinations to eliminate obtuse angles.

Speedwriting Shorthand. A comparatively recent development is the rapid spread of a system of copyrighted shorthand known as Speedwriting Shorthand. This system was formulated



"Now is the time . . ." as it is written in Speedwriting, a 20th-century system of rapid writing that competes with the older shorthand systems.

Speedwriting Publishing Co.

in 1922 by the American educator Emma Dearborn (d. 1937) and revised in *Century Edition of Speedwriting Shorthand* (1950), by the American educator Alexander Leon Sheff (b. 1898). An alphabetical system, Speedwriting Shorthand represents words by the use of letters of the alphabet and punctuation marks. Since it does

not involve learning new symbols, only about six weeks of training are required to attain an office dictation speed of 120 words per min. (wpm). Accuracy in transcription is gained because the stenographer reads back her own handwriting. Speedwriting is taught presently in business schools throughout the U.S., Canada, Great Britain, Latin America, Australia, and other parts of the world.

Machine Shorthand. Beginning in the last quarter of the 19th century, a number of machines, designed for the rapid recording of official speech or dictation appeared upon the market. The more successful of these were the Anderson, the Stenograph, the Stenotype, and the National. These machines are so constructed that all of the keys may be depressed simultaneously. A code is developed, so that an entire word may be written at one stroke. Once the abbreviations are memorized, the operator can record speech as rapidly as one can with manual shorthand. In the U.S. machine shorthand is widely used for court sessions, governmental hearings, and conventions, and is usually assigned only to specially trained and qualified reporters.

SHORTHORN. See CATTLE: *Breeds*.

SHORT SELLING, in finance and commerce, form of speculation based on anticipation of a decline in the prices of securities and commodities. Short selling occurs most frequently in connection with the sale of securities on stock markets; see STOCK; STOCK EXCHANGE. In this type of transaction, a seller undertakes to deliver to a purchaser a number of shares of a stock at the price prevailing at the time of sale. To effect the transaction, the seller, who does not have shares in his possession, borrows them from a broker, who receives a commission for his services. Subsequently, the seller "covers" by buying shares and delivering them to the broker. If he is able to buy at a lower price than he received, he realizes a profit; conversely, if he finds it necessary to cover at a higher price, he sustains a loss. The process of short selling on the commodity markets is similar; see HEDGING. J.M.

SHORT STORY, work of prose fiction, characterized by brevity and by strictly ordered economy of plot and character, developed as a specific literary form during the 19th century. The crucial problem of short-story writing is creating a balanced and rounded work of fiction within a limited space. The short story is similar to other fiction in that it not only tells a story but also makes an assertion about human character or experience. It contrasts with the novel, which affords many characters and rich sequences of

incident, and with the sketch, which is often comparatively formless and undeveloped.

In the short story the two constant elements of fiction, character and plot, are reduced to a minimum. Only one character or, at most, a small number of characters is given the semblance of full existence. The plot consists in the development and resolution of a single situation. In most short stories the reader is plunged immediately into the situation portrayed and is acquainted with the problem or the psychological tension which generates the conflict and the dramatic action. Thereafter the story rises to the crisis, in which the central character is forced to a decision. The resolution, which is known as the denouement, issues from the consequences of this decision.

In many stories the characters are developed only enough to carry the plot forward. In other stories the plot remains somewhat sketchy and is made secondary to the development of character. An accomplished writer maintains a delicate balance in this respect; the action of the story issues naturally and inevitably from the psychology of the characters.

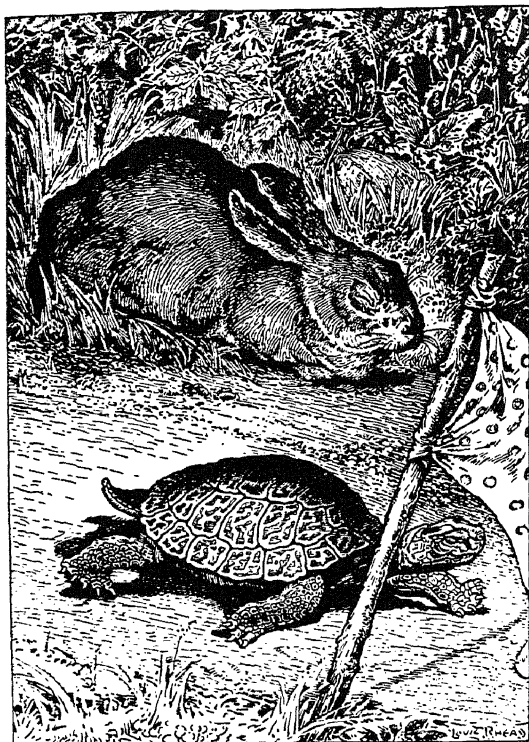
Atmosphere, which includes both the setting of the story and the unity of tone, dialogue, imagery, and assertion, is almost equal in importance to plot and character. Having decided upon the atmosphere which he wishes to create, the writer bends to his purpose every image and word, deleting everything that weakens or obscures it.

The last important element of the short story is the theme. A short story should embody as its theme either a particular, concrete view of human experience or a special moral awareness. By effectively expressing his theme the writer endows the story with meaning and significance.

Despite these severe principles of composition, the short story permits a considerable variety of forms and treatment.

Early History. The history of the short tale, of which the short story is the modern form, is almost as old as that of literature itself. Many of the incidents in the Old and New Testaments, for example, stand forth as dramatic and skillfully told stories. One of the earliest forms of short tale was the fable (q.v.) a story in which a moral or spiritual truth is presented symbolically. The most celebrated fables are those ascribed to the ancient Greek writer Aesop (q.v.).

In the medieval period brief mock epics enjoyed great popularity; several hundred of these works were collected in the anthology known as the *Gesta Romanorum* ("Deeds of the Romans",



Illustration, by Louis Rhead, of the race between the tortoise and the hare, a fable attributed to the Greek writer Aesop (620?–560 B.C.). Bettmann Archive

about 1250). The fabliau (q.v.), a comic or farcical tale in verse, belonged to the same period. Most fabliaux were broad, witty satires aimed at such targets as worldly clerics and comfortable merchants. Several such tales appeared in *The Canterbury Tales* (q.v.) by the 14th-century English poet Geoffrey Chaucer (q.v.). The novella, a tale of flirtations and intrigues recounted in an urbane, often ribald fashion, was developed in Italy during the 14th century. The most famous collection of novellas is *The Decameron* (q.v.), by the Italian writer Giovanni Boccaccio (q.v.). One of the most famous collections of stories is the *Arabian Nights* (q.v.), based mostly on Oriental folk tales.

Other early varieties of the brief narrative included folk tales (q.v.), which abound in the oral traditions of most countries, and ballads (see BALLAD), such as "Edward, Edward", and "Lord Randall", which are, in fact, compressed and effective stories.

The immediate predecessor of the short story was the sketch, a type of brief, informal essay, which enlivened periodicals of the 18th century. The sketch is essentially a criticism of contemporary manners and customs but is often semi-

fictional in form. In England, for example, the essayists Joseph Addison and Sir Richard Steele (qq.v.), authors of the daily journal the *Spectator* (1711–14), invented appropriate adventures for the imaginary country gentleman Sir Roger de Coverley (q.v.). In the early 19th century, periodicals such as the Scottish *Blackwood's Magazine* extended this practice by publishing works of pure fiction along with the customary poems, essays, and reviews. The short story proper was developed in response to this demand by periodicals for works of fiction short enough to be read at a single sitting.

The short story developed during the 19th and 20th centuries under the influence of various literary tendencies and movements. These influences were successively romanticism between 1800 and 1850, realism between 1850 and 1900, and naturalism (qq.v.), impressionism and symbolism (see SYMBOLISTS) from 1900 to the present. **The Romantic Short Story.** Writing within an age that placed great faith in the capacity of the imagination to search out the farthest reaches of truth, romantic writers consequently tended to

COMINCIA LA PRIMA GIOR.
NATA DEL DECAMERON, NELLAQVALE
dopo la dimostrazione fatta dall'autore, perche cagnone adice
nissi di doverli quelle persone, che appresso si mo-
strano ragunare a ragionare insieme, sotto il
reggimento di Pampinea si ragio-
na di quello che piu aggrada
a ciascheduno.



VANTVNGVE VOLTE GRATIC.
Se Donne meco pensando riguardo, quanto voi nase-
ralmente tutte siete pietose, tante conosco, che la pri-
ma opera, al vostro giudicio hauea graue, et nullo
principio, si come è la dolorosa ricordatione delle per-
sone, che quella uide, o altrimenti conobbe danosi,
no, che quella uide, o altrimenti conobbe danosi,
et lagime uole molto, laguale esse porta nella sua
fronte. Ma non uoglio perire, che quello di più uanti leggere si paueri quelli
sempre tra i sospiri, et tra le lagime leggendo dobbiate traspallare. Questo
borrido cominciamento ui ha non altrimenti, che è caminanti una montagna
aspra, et erta, presso alla quale un bellissimo piano, et diletteuole sia riposo, ab-
biamo tanto più uerne lor piaciuto, quanto maggiore è stata del faticare, et dello

The first page of a 16th-century edition of *The Decameron* by Giovanni Boccaccio. Bettmann Archive

compose tales having fantastic and even bizarre plots, using subtle allegories to express insights into the human heart and exhibiting a relative lack of concern with literal reality and social facts.

Among the most distinguished of the roman-
tic short-story writers were the German authors
Johann Ludwig Tieck and Ernst Theodor Wil-

SHORT STORY



Nathaniel Hawthorne

helm Hoffmann; the French authors Alfred de Musset, Alphonse Daudet, and Prosper Mérimée; and the American author Washington Irving (qq.v.). In the opinion of many critics the finest romantic short stories were written by the American authors Edgar Allan Poe and Nathaniel Hawthorne (qq.v.). Poe was a master of the tale of grim terror; his stories are enveloped in a powerful atmosphere of fear, violence, and madness. Hawthorne's style was, by contrast, slow and meditative, but he often used it to awaken in the reader an acute awareness of guilt and sin. Ostensibly, his subject matter is New England and its Puritan heritage, but his real theme is the conscience of man.

Realism. Writers of the realistic short story became active after the middle of the 19th century. They directed their attention to the matter-of-fact world that the romantics had neglected, believing that fiction should reflect without prejudice all of the objects it encounters. In practice, the realists were much more selective than this formula suggests, for they attempted to impose order upon the crowded details of experience.

The short stories of the French writer Guy de Maupassant (q.v.) are typical examples of the realistic school. An intelligent and sardonic man of the world, Maupassant reflected in his works every foible of French society. His plots, although at times careless, are invariably ingenious and his stories are enlivened by a dry, hard wit.

Many of the most celebrated short-story writers were Maupassant's disciples, including the British authors Rudyard Kipling and Somerset Maugham (qq.v.). Kipling's earliest and best

stories are portrayals of garrison life among the British in India. Somerset Maugham used Maupassant's methods of writing in his stories of drifters and sanctimonious missionaries in the South Seas.

Stories of the 20th Century. By 1900 realism dominated the short-story. Its acceptance was almost universal. At this time the number of magazines publishing short stories increased considerably, helping to create a mass audience that demanded facile amusement rather than literary excellence. Many writers of realistic short stories were willing to satisfy their demand. Gradually abandoning their attempts to reflect all of reality, they concentrated instead upon smooth construction, an easy charm of manner, and innocuous material. A much smaller number of writers was more concerned with literary excellence than with popularity.

One of the most successful early commercial writers was the American author William Sydney Porter (q.v.), who used the pen name O. Henry. The typical short story by O. Henry is almost a mechanical contrivance, a glib narrative climaxed by the so-called surprise ending for which he became famous. O. Henry's contemporaries, the British writer William Wymark Jacobs and the American writer Richard Harding Davis (qq.v.) were among the many other writers producing short stories at the same level of easy competence.

Contemporary with these writers were two of undoubted genius, the American author Henry James and the British author Joseph Conrad (qq.v.); the latter, although born a Pole, became

Guy de Maupassant

Bettmann Archive



SHORT STORY

a craftsman of faultless English prose. A profound moralist and a brilliant technician, James was determined to restore and extend the range of the short story. He was a scrupulous and exacting dramatist of subtle psychological states; Conrad called him a "historian of fine consciences". The phrase applies equally to Conrad himself. Having been a captain in the British merchant service, Conrad had a first-hand



Joseph Conrad

Bettmann Archive

knowledge of sailors and the sea. His stories are not adventure yarns, however, but taut and vivid stories of men tormented by conflicting loyalties.

The short-story renaissance that began in the early decades of the present century owes much to the example set by James and Conrad, but new forces contributed to it also. The impressionistic short story was largely the creation of the Russian author Anton Pavlovich Chekhov (q.v.). Impatient with the contrived plots and formulas of conventional fiction, Chekhov attempted to record an exact impression of a scene or an encounter in such a way as to elicit from the reader an exact response. At first reading, many of Chekhov's stories seem formless, but each one, built up of nuances and half tones, is shaped firmly by the discipline of his art.

Naturalism and symbolism both contribute to the brilliant effect of the short stories in the volume *Dubliners* (1914) by the Irish author James

Joyce (q.v.). Naturalistic writers attempt to report events with scrupulous objectivity; by withholding any direct comment of their own, they permit the narrative to carry its own meaning. In his stories, Joyce records with an almost painful accuracy the meanness and provinciality of life in his native city of Dublin. Yet each detail is charged with such latent power that it takes on the force of a symbol, suggesting to the reader a rich meaning beneath the drab-seeming surface.

Both Chekhov and Joyce directly influenced later writers of short stories. The German-American novelist, critic, and short-story writer Thomas Mann (q.v.) had less of an influence than Chekhov and Joyce, but he approaches them in stature. His short stories, which are written in a tone of stately and occasionally ponderous irony, probe the moral structure of bourgeois society and examine the nature and personality of the artist.

The Austrian writer Franz Kafka (q.v.) was the master of a very different kind of German prose. Kafka's stark, haunting tales are allegories of modern man; his heroes, living lonely lives in great cities, seek justice stubbornly and with futility in a world that seems to deny the existence of justice.

The Present Day. The contemporary short story owes a debt to all of these powerful innovators. The British writer Katherine Mansfield (q.v.) was clearly a pupil of Chekhov. Her deli-

Franz Kafka

Bettmann Archive



cate stories, marked by her sharply feminine personality, attempt to capture elusive moments in time. The Irish writers Seán O'Faoláin (1900–) and Frank O'Connor (pen name of Michael O'Donovan, 1903–66) also were disciples of Chekhov. Their short stories are vigorously written and marked by vivid characterization. O'Connor's stories are especially notable for their sparkling wit.

The British novelist, poet, and short-story writer D. H. Lawrence (q.v.) portrayed in condensed form in his short stories problems and situations that he treated more fully in his novels. Prominent among these problems are the lack of natural balance and intensity in modern life and the ways by which they may be restored. The American author William Faulkner (q.v.) dealt significantly in his short stories, as in his novels, with the South. In his stories the human situations resulting from the broken social forms of the South reflect problems of human heroism and doom.

The American author Ernest Hemingway (q.v.) holds a particularly eminent position among short-story writers. His sure touch conveys his meanings through understatement and sparse elliptical dialogue; these devices many other writers have tried to imitate. Hemingway's stories of boyhood in the Michigan woods, of the ironic wisdom that war engenders, and of the courage of the bull ring, are written in hard, firm prose that does not waste a word.

A number of other modern writers have produced distinguished short stories. The American author Eudora Welty (q.v.) deals with life in a Mississippi village in short stories marked by both humor and pathos. The short stories of the Italian author Alberto Moravia (q.v.), a master of the harshly realistic school of Italian writing, are greatly respected, especially by European authors. Those of the Russian author Isaak Emmanuelovich Babel (1894–1941) reveal a vivid and energetic talent. The short stories of the American authors Katherine Anne Porter (q.v.) and Jean Stafford (1915–) are rich in psychological insights and subtle perceptions. The stories of the American writer Jerome David Salinger (q.v.) are notable for their wry, near-mystic view of life; those of the American authors John O'Hara, whose style is tense in the manner of Hemingway, and John Updike (qq.v.), who writes florid, mannered prose, are alike in their ironic realism.

Useful anthologies of the short story, often with accompanying critical material, include *The Short Story* (1948) by Seán O'Faoláin, *The House of Fiction* (1951) by the American critics

Caroline Gordon (1895–) and Allen Tate (q.v.), *Understanding Fiction* (1959) by Cleanth Brooks (1906–) and Robert Penn Warren (q.v.), and *Studies in Change; A Book of the Short Story* (1965) by Hugh Kenner (1923–).

SHOSHONE FALLS, cataract of the Snake R. in s. Idaho. After flowing through a long, deep canyon, the river makes a plunge of 212 ft. over a basaltic horseshoe rim almost 1000 ft. wide. The height of the falls exceeds that of Niagara Falls (q.v.). The volume of Shoshone has been reduced in recent years by irrigation projects.

SHOSHONI, North American Indian tribe speaking a language belonging to the Shoshonean branch of the Uto-Aztecan linguistic family; see AMERICAN INDIAN LANGUAGES: *Classification of Languages*. The tribe formerly lived in the mountainous lands of western Wyoming and Montana, central and southern Idaho, and parts of Utah, Nevada, and Oregon. In common with their neighbors, the Bannock and the Piute (q.v.), the Shoshoni are often popularly designated the Snake Indians. About 3500 Shoshoni survive on reservations in Idaho, Wyoming, and Nevada. See AMERICAN INDIANS: *Indians of the United States and Canada: Plateau Area*.

SHOSTAKOVICH, Dimitri Dimitrievich (1906–75), Soviet composer, born in Saint Petersburg (now Leningrad), and trained at the Leningrad Conservatory (1919–25). Shostakovich first attracted international attention with the premiere of his First Symphony (1926), composed when he was still at the Conservatory.

Dimitri Shostakovich

UPI



SHOTGUN

His music is distinguished principally by two features: its rhythmic vitality, and its rich melodies, which are frequently reminiscent of the gypsy tunes popular in eastern Europe (see *Folk Music: Hungary and Eastern Europe*). Most of his large works are composed in the traditional form of the sonata (q.v.), and his mature harmonic style is usually simple and direct. His technical mastery of the orchestra is particularly notable.

Shostakovich's Second Symphony (1927), composed to celebrate the tenth anniversary of the Russian Revolution (q.v.), Third Symphony (1931), and Fourth Symphony (1936), all proved less successful than the first. His first opera, *The Nose* (1929), modelled on the expressionistic and atonal techniques of such Western composers as the German Paul Hindemith and the Austrian Alban Berg (qq.v.), was well received by the critics and public but was censored by official Communist Party officials as bourgeois and decadent. Shostakovich's next opera, *Lady Macbeth of Mtsensk* (1934), again received both popular and critical acclaim, but party publications condemned the opera as being counter-revolutionary. Such attacks led Shostakovich to promise to reformulate his artistic ideas.

His Fifth (1937) and Sixth (1939) symphonies were well received, both by the party and the public, and his Seventh Symphony (1942), composed during the World War II siege of Leningrad (q.v.) and known as the "Leningrad Symphony", became a great popular success. In 1948 his music was again attacked on political grounds, and once more he promised to reform his musical style. He apparently did so to the satisfaction of the Soviet government and he received the Order of Lenin, the supreme Soviet honor, in 1956. Shostakovich was also awarded the Stalin Prize for his compositions on several occasions, and in 1966 received the accolade of Hero of Socialist Labor, the first composer to receive this Soviet honor. In 1972, his Fifteenth Symphony, a purely instrumental, four-part composition, was well received in Moscow.

Among his other works are a Piano Concerto (1933), Sonata for Cello and Piano (1934), String Quartet (1938), Piano Quintet (1940), and six symphonies between 1943 and 1962. He also composed music for ballets, songs, and scores for motion pictures.

SHOTGUN, shoulder gun that discharges from a smoothbore barrel a quantity of small, round pellets, or shot, each time it is fired. The primary use of the shotgun is in the hunting of waterfowl, game birds, and small animals. Shotguns are also used in two forms of sport shooting

called skeet and trap, in which breakable targets are thrown into the air by a device called a trap. The number of shot in a cartridge, called a shot-shell or shell, depends on the size of the pellets and the weight of shot. The weight of shot in a cartridge depends on the size of the bore, or interior diameter, of the barrel.

COMMON SHOT SIZES

Size No.	Diameter in inches	Pellets per oz.
12	.05	2385
9	.08	585
8	.09	409
7½	.095	345
6	.11	223
5	.12	172
4	.13	136
3	.15	88
BB	.184	50
Air rifle	.175	55

Shotgun bore size is specified by gauge number, the gauge being the number of lead balls of the same diameter as the bore required to weigh 1 lb. Thus, in a 10-gauge shotgun, ten of the lead balls weigh 1 lb. Standard gauges are 10, 12, 16, 20, and 28. The 0.410-bore is not sized in gauge, but in caliber; its bore is 0.410 in. in diameter.

The maximum effective range of a shotgun with birdshot is about 50 yd. Single-projectile shotshells, called slugs, are used in the hunting of medium-sized game, such as whitetail deer. Effective maximum range with slugs is about 80 yd., as compared with ranges of several hundred yards for high-powered hunting rifles.

Shotguns are made in a number of types. The most familiar is the double-barrel, which has two barrels mounted side by side and a separate firing mechanism, or lock, for each barrel. Firing may be by two triggers, one for each lock, or by a single trigger that fires the barrels in succession. A variant of the double-barrel gun is the over-under, in which the barrels are mounted one above the other. A third type is the single-barrel, or single-shot, which may be breech loading or have single-shot or repeating-bolt action. A combination gun is a multibarrel firearm with one or two shotgun barrels and one or more rifled barrels. Other common shotgun types are the slide-action, or pump, and the semiautomatic, or self-loader; these are the most popular types in use today. These guns are generally alike in construction, having a single barrel, a tubular magazine, and a sliding breech-block to feed shells to the chamber and hold them in place during firing. Modern guns are termed hammerless; that is, the hammers are concealed and are cocked automatically as the gun is opened or closed.

To regulate the spreading of the shot after it

leaves the barrel, the bore of most shotguns is constricted at the muzzle end. The difference in diameter of the barrel and the constricted section, called the choke, determines the degree of spread. Shot spreads most from an unconstricted barrel, called a cylinder bore; it spreads least from a barrel with about 0.030-in. to 0.040-in. net constriction, called a full choke. Only limited control can be achieved even with a full choke; any additional constriction results in greater spread of the shot swarm. At a 40-yd. range, the standard testing distance for most guns, the full-choke gun limits the shot spread to a radius of about 15 in. See also SMALL ARMS. **SHOVERLER**, small freshwater duck, *Anas clypeata*, in the Duck family, Anatidae, having a broad, flat bill. It is from 17 to 20 in. in length and found along coasts and rivers throughout the Northern Hemisphere in summer, migrating southwards in winter. The upper part of the distinctive bill is longer than the lower. Shovelers feed in shallow waters on insects, mollusks, and roots, straining mud and water out of the serrated sides of their bills. Males are mostly greenish black and white with chestnut patches on the underside and light-blue patches on the wings; females are mottled brown with blue wing patches. The birds nest in grass at some distance from the water. The only North American species is *A. clypeata*. Although shovelers are sometimes called spoonbills, they should not be confused with the long-legged wading bird of that name; see SPOONBILL.

SHOWBOAT, in United States history, a floating theater used to present popular plays, vaudeville, concerts, and circus acts. Usually propelled by steam or transported by steam tug, these boats went up and down the rivers of the U.S., especially the Mississippi R., from early in the 19th century until the late 1920's. They ranged from crude rafts with an improvised auditorium and stage to large steamships with elaborate, well-equipped theaters. The company frequently included members of the family of the owner, with added traveling players as necessary. A few showboats still operate, but as a whole the tradition belongs to the 19th century and the period immediately before and after World War I. It is memorialized in the novel *Show Boat* (1926) by the American writer Edna Ferber, which was later made into a successful musical play by the American composers Jerome Kern (qq.v.) and Oscar Hammerstein, 2nd (see under HAMMERSTEIN).

SHRAPNEL, name applied to an artillery fragmentation shell invented in 1784 by the English artillery officer Lieutenant Henry Shrapnel

(1761–1842), and today broadly denoting any projectile fragments; see ARTILLERY. His invention was adopted by the British artillery nineteen years later and named after him. In its original form, the shell was spherical-shaped and contained a minimum explosive charge, small lead balls which themselves came to be known as shrapnel, and a fuze (q.v.) to explode it in the air above enemy troops. Shrapnel was later placed into cylindrical shells and used extensively, especially during World War I. The effectiveness of shrapnel discouraged mass battlefield formations and contributed to the trench-type warfare characteristic of World War I (q.v.). Fragmentation projectiles in the form of bombs, mortar shells, and grenades proved more effective after World War I, and the shrapnel shell became obsolete. See BOMB; GRENADE; MORTAR; SHELL; SHOTGUN.

SHREVEPORT, city in Louisiana, and parish seat of Caddo Parish, on the Red R., about 325 miles N.W. of New Orleans. The city is served by several railroads and airlines. Shreveport is the headquarters of the natural-gas industry of the surrounding region, and is also the distribution and trade center for the oil and lumber produced in the area. A manufacturing center, the city has oil refineries and plants producing apparel, chemicals, processed foods, machinery, and metal products. Shreveport is the seat of Centenary College of Louisiana, founded in 1825. The annual Louisiana State Fair is held in the city. Nearby is Barksdale Air Force Base. Shreveport was founded as Shreve Town in 1836 and named for the American steamship captain Henry Miller Shreve (1785–1851), who opened the Red R. to navigation. It was incorporated as the town of Shreveport in 1839 and was chartered as a city in 1871. The city served as the Confederate capital of Louisiana in 1863. Pop. (1960) 164,372; (1970) 182,064.

SHREW, common name applied to numerous, extremely small mammals related to the mole (q.v.), comprising the family Soricidae in the order Insectivora. The animal is mouselike in general appearance but has a long, pointed snout and soft, gray-brown, velvety fur. Most species live on the ground, although a few species are semiaquatic or arboreal. Shrews, active, nocturnal animals, feed on insects and worms primarily, but also kill and eat mice many times their own size. Many species have glands, located on the knees and elbows, from which a fluid with a disagreeable odor is secreted.

The Shrew family is the largest among the Insectivora and numerous species are found on all major land areas of the world except the polar



Elephant shrew, family Soricidae

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regions, Australia, New Zealand, Greenland and Tasmania. In the United States the most common genera are *Sorex*, containing the long-tailed shrews, and *Blarina*, containing the short-tailed shrews. Animals in the genus *Sorex* are slightly less than 3 in. long. The ears are large and the teeth are brown at the tip. Five to seven young are produced in a litter each spring. The mole shrew, *B. brevicauda*, the most common shrew in eastern U.S., is about 4½ in. long. The tree shrew is not a true shrew but a shrewlike primate.

SHRIKE, common name applied to any of numerous passerine birds, found throughout the world, which comprise the family Laniidae. The bird is characterized by a notched bill that is broad at the base, hooked at the tip, and resembles the bill of larger birds of prey. The tail is proportionately long and rounded and the wings are short. The plumage is predominantly gray, black, and white. The song consists of a sweet, variable warble, interspersed with harsh, prolonged cries similar to those of the catbird. Shrikes feed on insects and worms, which they impale on thorns, sharp twigs, or the barbs of a wire fence. Some of the larger shrikes, called butcherbirds, also attack and feed on small birds and mammals. The birds nest in thickly branched trees or in masses of interlacing tangles of vines or twigs. They lay from four to seven eggs, which are colored in various tints of gray, green, or bluish green, with spots of brown, lavender, and gray.

North American shrikes belong to the genus *Lanius*. The northern shrike, *L. borealis*, which is about 10½ in. long, breeds in Canada and winters in the United States; it is also found in the Old World. The loggerhead shrike, *L. ludovicianus*, smaller than the northern shrike, breeds in the U.S. and is common in the south and south-west.

SHRIMP, common name most generally applied to a number of genera of decapod crusta-

ceans of the suborder Macrura; see CRUSTACEA: DECAPODA. Shrimp are usually called prawns in some Oriental and Old World areas; see PRAWN. They are closely related to the lobster and crayfish and, more distantly, to the crab (qq.v.). The anterior cephalothorax of the shrimp has prominent antennae, stalked eyes, a serrated rostrum (beaklike prolongation) and five pairs of walking legs. The seven-segmented abdomen or tail has five pairs of swimming legs and a terminal telson or tail spine.

Shrimp are found in both fresh water and salt-water. They generally live on or near the bottom, and may burrow into a mud bottom or swim pelagically (that is, in the open sea). Most species live in shallow water; others live at depths of several hundred fathoms. Some grow to more than 1 ft. in length, but most species are somewhat smaller. The color varies considerably from red to whitish, tinged with green, pink, or black. Some have distinctive spots or other markings.

Shrimp are a very popular food resource and support extensive fisheries around the world. The most common commercial species in waters near the United States is the white shrimp, *Penaeus setiferus*. In the U.S. about 120,000 tons of shrimp, valued at about \$82,000,000 to fishermen, have been landed in one year; U.S. shrimp imports have totaled about 80,000 tons annually; and the recorded world catch in a recent year was more than 700,000 tons.

Some other crustaceans may be referred to as shrimp, for example, the opossum shrimp (in the order Mysidacea) or the mantis shrimp or prawn (in the order Stomatopoda).

SHROPSHIRE, or **SALOP**, Great Britain, border county of w. England. The Severn, the principal river, is navigable throughout. To the N. and N.E. of the Severn the county is generally level and is under tillage; to the S. and S.W. it is hilly and mountainous, the Cleve hills rising to an altitude of 1800 ft. Here cattle breeding is extensively carried on. A breed of horned sheep is peculiar to this county. Shropshire is also remarkable for its mineral wealth. Coal, iron, copper, and lead fields at Coalbrookdale, Snedshill, and Ketley are extensively worked, and there are important iron industries. The county town is Shrewsbury. Area, 1346 sq.mi.; pop. (1971) 336,934.

SHROVETIDE, in Christianity, period of three days, immediately preceding Ash Wednesday (q.v.), given over to preparation for Lent (q.v.). The chief part of the preparation consisted in being shriven, or having one's confession (q.v.) heard. "Shrove" is the past tense of "shrive", of which "shriven" is the past participle; hence the

name "Shrovetide". After the duty of confession was fulfilled, the faithful were permitted to indulge in amusements. The period as such is no longer observed, but a survival of the frolic is the carnival of some European countries. In England, football, cockfighting, and bullbaiting (qq.v.) long were recognized pastimes of Shrovetide. The Mardi Gras (Fr., "fat Tuesday") celebrated by the French is Shrove Tuesday, the last day of Shrovetide.

SHRUBS, plants that differ from herbs in being woody, and that differ from trees chiefly in height, but partly also in the development of numerous primary shoots of approximately equal value. The distinction is largely artificial, because many transitions or overlappings exist between these groups.

SHUBERT, name of three American theatrical producers and theater owners who were brothers: **Lee Shubert** (1875–1953), **Sam S. Shubert** (1876–1905), and **Jacob J. Shubert** (1880–1963).

The brothers, all born in Syracuse, N.Y., moved to New York City in 1900, where they leased the Herald Square Theater, the first of an empire that at its height included more than sixty theaters throughout the United States. Beginning as theater owners and operators, the Shuberts soon became producers of plays and managers of performers as well. They produced more than 500 plays, including many operettas by the American composers Sigmund Romberg and Victor Herbert (qq.v.), and among the performers they managed were the American entertainers Al Jolson and Eddie Cantor and the French actress Sarah Bernhardt (qq.v.). Their offices in the Shubert Theater in New York City were alongside an open passageway now known as Shubert Alley, in the heart of the Broadway theater district.

SHUFFLEBOARD, game in which two or four players use 6-ft. cues to shove disks of wood, or steel encased in plastic into scoring areas on a marked court. A standard shuffleboard court, which is 52 ft. long and 6 ft. wide, consists of two identical halves separated by an intervening neutral zone. On each side of the neutral area is a triangular scoring zone; at each end of the court is a rectangular shooting area. Players slide disks across the neutral zone into the farther triangular scoring area. Each triangle is divided into three sections designating 10 points, 8 points, and 7 points, respectively. Opposing players stand side by side and shoot to the opposite triangle, attempting to score points and to block the path of an opponent's shot or to knock his disks into a penalty area, which represents minus 10-points.

Played since the Middle Ages, shuffleboard derived apparently from curling (q.v.) or lawn bowling. Long popular as a deck game aboard ship, shuffleboard was played in 1900 on hard-packed sand at Daytona Beach, Fla., from which it spread to all parts of the United States. In 1931 it was so widely played that a National Shuffleboard Association was set up and the game was standardized.

SIALKOT, city of Pakistan, in Punjab Province, about 70 miles N.E. of Lahore. The city is a rail junction and a major trade and processing center. It has a variety of light manufactures, including bicycles, surgical instruments, and sporting goods. The chief points of interest are the shrine of Guru Nanak (1469–1539), founder of the Sikh religion (see **SIKHS**), and a 12th-century fort. Pop. (greater city; 1971 est.) 168,000.

SIAM. See **THAILAND**.

SIAMESE TWINS, name popularly applied to twins congenitally united in a manner not incompatible with life or activity. The name derives from the famous twins Eng and Chang (1811–74), born of Chinese parents in Siam (now Thailand). Eng and Chang were joined together at the sternum by a thick, muscular ligament. They toured the world as an attraction, married two normal sisters, and had a total of nineteen children. Their deaths occurred three hours apart. Siamese twins may be connected at the hips, buttocks, or other parts of their bodies and may have one or more organs in common. Joined twins are always of the same sex. Surgical separation is sometimes possible, but the operation is usually fatal to one of the twins. An operation was successfully performed in 1953 on twins who were joined near the base of the spine and shared the lower intestinal tract. See also **MULTIPLE BIRTH**.

SIAN or **CHANGAN** or **SIKING**, city in the People's Republic of China, and capital of Shensi Province, on the Wei R., about 400 miles N.W. of Hankow. The city is a flourishing commercial center and is served by the Lung-Hai Railway, which provides connections with Tungkwan and with points in central and E. China. One of the oldest cities in China, Sian has figured prominently in Chinese history from antiquity to modern times. It was founded by the Chou dynasty in the 12th century B.C., and during the reign (246–210 B.C.) of Shi Hwangti the city was styled Kwan-chung and became capital of all China. Under the Han dynasty (202 B.C.–9 A.D.) Sian, then known as Wei-nan and Nui-shi, reputedly attained a population of 4,000,000. In the 7th and 8th centuries A.D. the city was the seat of numerous Christian missions, including

SIANGTAN

many established by the Nestorian sect; see NESTORIANS. The Italian traveler Marco Polo (q.v.), who visited Sian in the 13th century, was deeply impressed by its trade and industry. In modern times, Sian received international notice as the scene of the kidnapping, in December, 1936, of the Chinese Nationalist statesman Chiang Kai-shek (q.v.), by Marshal Chang Hsueh-liang, an advocate of united action by Chinese Nationalists and Communists against Japan. Sian was captured by a Communist army in the summer of 1949, during the Chinese civil war.

Noteworthy points of interest in and near Sian are the encircling fortifications, the tombs of the T'ang emperors, a colossal image of Buddha (q.v.), and the historical museum. Among the museum exhibits is the celebrated Nestorian tablet, an inscribed stone slab dating from the 8th century, which contains an abstract of Christian doctrine and an account of the early Church in China. Pop. (1970 est.) 1,900,000.

SIANGTAN, city of the People's Republic of China, in Hunan Province, on the Siang R., about 300 miles N. of Canton. It is a regional trade center, and since 1949 has become important for the manufacture of chemicals, machine tools and electrical goods. Pop. (1970 est.) 300,000.

SIBELIUS, Jean (1865–1957), Finnish composer, born in Hämeenlinna, and educated at the Helsinki Conservatory. He studied composition in Vienna under the Hungarian composer Karl Goldmark (q.v.). Sibelius taught theory at the Helsinki Conservatory from 1892 until 1897, when he received a government annuity that enabled him to concentrate solely on composition. With the exception of a few trips abroad, he lived for the rest of his life at Järvenpää on the outskirts of Helsinki. He stopped composing in 1929.

The leading composer of Finland, Sibelius is also considered one of the chief symphonic composers of the 20th century. His music is inspired largely by nature and by Finnish legends, such as the Finnish national epic the *Kalevala* (q.v.). Although actual folk songs are not employed in his compositions, Sibelius used melodic and rhythmic patterns characteristic of Finnish folk poetry and music. Most of his music is highly nationalistic, and one of his most famous pieces, the tone poem *Finlandia* (1899, revised 1900), was banned by the Russian rulers of Finland because it aroused much patriotic fervor among the Finns.

A characteristic feature of Sibelius' style is the frequent use of short motifs that are continually transformed and that finally evolve into com-

plete melodies. At his best in symphonies and symphonic poems, he was a master of orchestral technique. The last exponent of 19th century romanticism in music, he was concerned with preserving formal structure and in this way was influenced by the German composer Johannes Brahms (q.v.).



Jean Sibelius

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Other principal works of Sibelius include seven symphonies, written between 1899 and 1924, and the symphonic poems *En Saga* (1892, revised 1901), *The Swan of Tuonela* (1893), *Nightride and Sunrise* (1909), *The Oceanides* (1914), and *Tapiola* (1925). Sibelius also wrote chamber and choral music and pieces for the piano as well as songs. His famous *Valse Triste* ("Sad Waltz", 1903) was originally composed as incidental music for a play.

SIBERIA (Russ. *Sibir*), vast area in the Soviet Union, comprising the Asian portion of the Russian S.F.S.R. (q.v.) and including all the territory of the Soviet Union in Asia, except Kazakhstan S.S.R., Uzbek S.S.R., Turkmen S.S.R., Kirghiz S.S.R., Tadzhik S.S.R., and Kara-Kalpak A.S.S.R. Siberia extends s. from the Arctic Ocean to Mongolia, and e. from the Ural Mts. to the Pacific Ocean, and includes the island of Sakhalin and the Kamchatka Peninsula. The greater part of the area is contained in the Buryat A.S.S.R. and the Yakut A.S.S.R., the Krasnoyarsk, Khabarovsk, Altay, and Maritime territories, and several large oblasts, notably Novosibirsk, Irkutsk, Chita, and Tomsk. The most important Siberian cities include Barnaul, Biysk, Birobidzhan, Ir-

kutsk, Khabarovsk, Komsomol'sk, Krasnoyarsk, Novosibirsk, Omsk, Tomsk, and Vladivostok (qq.v.). Siberia covers an area of about 6,086,680 sq.mi.

Physical Features and Climate. For about a third of its area, from the Ural Mts. to some distance beyond the Yenisey R., Siberia is a great plain with few sharp elevations, sloping generally downward from s. to n. In the w. part of this section of Siberia are large areas of swamp, through which are scattered thousands of small lakes, relics of the Ice Age. To the e. of the Yenisey R. a number of mountain ranges extend generally from s.w. to n.e., giving the region a mountainous character. The chain composed of the Yablonovyy and Stanovoy ranges extends without interruption from the Chinese frontier n.e. to the Bering Strait, a distance of about 4300 mi. Besides these two chains, the highest Siberian ranges include the Altay Mts., between Mongolia and the Sinkiang-Uighur Autonomous Region of China, and the Sayan Mts., an extension of the Altay chain, in the Tuvian A.S.S.R. A chain of volcanic mountains extends the entire length of the Kamchatka Peninsula in n.e. Siberia, reaching elevations of from 10,000 to nearly 15,000 ft. above sea level.

The shore of the Arctic Ocean is low and flat. Almost the entire n. section of Siberia, extending from the ocean s. for about 250 mi., is tundra (q.v.), treeless and marshy plains that are perpetually frozen to great depths, in some places to 650 ft. The tundra surface thaws sufficiently in summer to permit short-lived vegetation. Near the Arctic Circle the tundra gradually merges into marshes and a forest belt which, in w. Siberia, extends to the s. agricultural region. The Siberian forests, called taiga, are considered the densest and most extensive in the world, except for the forests of the Amazon in South America. With its extensions into the forest belt of the European Soviet Union, the Siberian taiga occupies 3,900,000 sq.mi. The Pacific coast is fringed by high, forested mountains. Lake Baykal (q.v.), in the Buryat A.S.S.R. of southern Siberia, is the largest fresh-water lake in Asia.

Siberia is traversed by a network of large rivers, four of which, the Lena, Yenisey, Amur, and Ob' (qq.v.), are among the fourteen longest in the world. Together, these rivers provide about 30,000 mi. of interior navigation. The most important river, the Ob', and its tributary, the Irtysh, flow through the most fertile and populous areas of Siberia for about 3200 mi. These rivers are frozen from six to nine months of each year.

Siberian winters are long and severe but exceedingly dry; in some areas snowfall is so scant

that sleds cannot be used for transportation. Summers are short and hot. In the agricultural districts of both e. and w. Siberia the mean annual temperature is about 32° F. Temperatures of -93° F. in winter and 93° F. in summer have been recorded in Verkhoyansk, in the n. central region. Except for the Pacific Coast area, rainfall is small and frequently insufficient for crop growing. In the frozen tundra region, layers of ground ice are found beneath the surface of the soil. These ice layers are exceedingly thick, and frozen and preserved prehistoric mammoths have frequently been found in them.

Flora and Fauna. Perennial mosses, lichens, and stunted shrubs, interspersed with flowering plants in summer, grow on the treeless tundra. The most common and hardy tree found in the taiga forest, which is broken only by waterways and narrow ravines, is the larch. Other common Siberian trees include the pine, Siberian cedar, birch, and poplar. Siberia is one of the major sources of furs in the world. Fur-bearing animals include the polar hare, otter, sable, ermine, wolf, bear, several varieties of fox, and the gray squirrel. Leopards and Manchurian tigers are found in the region of the Amur R. Domesticated reindeer are used for transportation purposes in various northern areas, and camels are used in the south.

Production and Industry. Siberia is potentially one of the most productive regions of the Soviet Union, but because of the severity of the climate and the difficulty of transportation, it is one of the least developed areas. Much of the s. region was opened up by the 5500 mi. Trans-Siberian Railway completed in 1903. Cities and towns were built along the route of the railroad, some of the most important at points where communication facilities meet. Krasnoyarsk is built on the Yenisey R., Novosibirsk on the Ob', Omsk on the Irtysh and Khabarovsk where the Trans-Siberian Railway crosses the Amur R. In recent years air transport has become a primary method of spanning the vast distances between the European Soviet Union and remote Siberian towns. Siberia is regarded as the pioneering region of the U.S.S.R., and the Soviet government has emphasized the economic development and industrialization of Siberia in its Five-Year Plans.

The predominant industries of Siberia are mining and agriculture. Siberian coal deposits are among the largest in the world. The Kuznetsk Basin (q.v.), in w. Siberia, is estimated to contain more than 440,000,000,000 tons of coal as well as extensive deposits of iron ore. Other exceedingly rich coal mines are in the Cherep-

SIBERIA

khovo and Minusinsk areas. Siberian mines supply two thirds of Soviet gold, found especially in the valley of the Lena R. and at Bodaybo on the Vitim R. Silver is mined chiefly in the vicinity of Nerchinsk, in the s.e. Other Siberian mineral resources include graphite, copper, lead, tin, zinc, uranium, and manganese. Siberian industrial establishments presently include metallurgical and chemical plants; textile factories; plants for the manufacture of tanks, tractors, and agricultural implements; flour mills; sawmills; and glass, brick, cement, and pottery works.

Siberia contains about 12 percent of the cultivated land of the Soviet Union. The leading crop is spring wheat, followed by oats, rye, and barley. Most of the farming area is in w. Siberia, extending from the Ural Mts. approximately to Lake Baykal, about 180,000 sq.mi. Since the beginning of the Soviet regime the cultivable area has been consistently developed to the n.; in the late 1960's reforestation, terracing, and other techniques preventing erosion were implemented in e. Siberia in order to improve the soil available for cultivation. Crops planted in this region include potatoes, cereal grains, sugar beets, and flax. Other agricultural activities include dairying, meat packing, and the processing of hides.

History. According to historical and archeological research the earliest-known inhabitants of Siberia were scattered Asian tribes who lived in the southern regions. In the 16th century Tatars (q.v.) emigrating from Turkestan subjugated the tribes of the s.w. Siberian plains and organized a khanate with its capital at Sibir on the Irtysh R., thus giving the region its eventual name. Russian expansion eastward into Siberia was begun in the 16th century under Czar Ivan IV Vasilievich, called Ivan the Terrible (*see under* IVAN), and was largely conducted by the Stroganov family of Novgorod, which obtained various farming and mining concessions from the czar. In 1579, with the permission of the czar, Semën Stroganov (d. 1583), sent an expedition of about 800 men under the command of an outlaw, Ermak Timofeev (d. 1584), into w. Siberia. Ermak defeated the Tatars, captured Sibir, and was pardoned and rewarded by the czar. The Russian city of Tobol'sk was built on the site of Sibir in 1587, and many forts, or ostrogs, were built at strategic points to facilitate Russian defense of the new region. The Siberian tribes offered little resistance to Russian expansion except in the s., and, skirting hostile areas, Russian explorers and traders advanced to the e. and n.e. By 1639 they reached the Sea of Okhotsk. At this period Russian Siberia ex-

tended s. to the Irtysh R., the boundary of Mongolia, and to the Amur R. In 1651 a Russian detachment under the explorer Yerofey Khabarov reached the Amur.

Far from imperial supervision, the Russian soldiers and traders ruled the Siberian colonies as they pleased, treating the natives harshly and collecting exorbitant taxes. Russian abuses in the Amur region impelled the Manchu government of China to protest in behalf of the Chinese who had settled there; *see* MANCHURIA. After decades of hostility Sino-Russian relations were temporarily improved by the Treaty of Nerchinsk in 1689 which restricted Russian control to the northern portion of the Amur region. The czars gave little attention to development of their Siberian possessions. Because of the extreme climate and rigorous living conditions Siberia became, beginning with the reign of Czar Boris Fëdorovich Godunov (q.v.), a place of exile for political, religious, and criminal offenders. Few settlements were established, and governors were rarely held to account for their activities by the imperial government.

In 1848 Count Nikolai Nikolaevich Muraviev-Amurski (1809?–81) was appointed governor general of eastern Siberia. He began an expansionist policy in the Amur region, and, in 1854, led an expedition down the Amur. In 1858, he concluded the Convention of Aigun with China, which gave to Russia the left bank of the disputed river. In 1860, by the Treaty of Peking, Russia secured all the Siberian territory to the Pacific Ocean; Vladivostok, founded in the same year, later became the chief Russian naval station on the Pacific. With its hold on the coast assured, in 1891 the imperial government began to build the Trans-Siberian Railway. In 1891 about 5,000,000 inhabitants populated all Siberia; by 1910 the population was about 9,000,000.

Russia also obtained concessions in the Liaotung Peninsula by intervention in the Sino-Japanese War of 1895, and established there the naval station of Port Arthur and the free port of Dairen; *see* LÜTA. Russian policies in northern China, however, came into conflict with increasing Japanese imperialism; when Russia refused to withdraw from Manchuria, Japan attacked Port Arthur in 1904 (*see* RUSSO-JAPANESE WAR), and by the Treaty of Portsmouth ending the war, Russia was forced to retreat from Manchuria.

After the Bolsheviks seized power in Russia (*see* BOLSHEVISM) in 1917, the Allied forces of Europe sent an expeditionary force into eastern Siberia. At the end of 1918, with Allied support, Admiral Aleksandr Vasilievich Kolchak (q.v.)

succeeded in uniting the counterrevolutionary groups into an autonomous Russian government with its headquarters at Omsk in western Siberia. In 1919, however, the Kolchak government was overthrown by the Bolsheviks, and an autonomous Far Eastern Soviet Socialist Republic was established. In 1922 the republic was incorporated into the Russian S.F.S.R.

The development of Siberia became one of the major goals of the Soviet economy. Under Soviet direction the population of Siberia increased from about 10,400,000 in 1914, to over 22,000,000 in 1933, at the end of the first Five-Year Plan. The increased population included several million inhabitants of other parts of the Soviet Union sentenced to forced labor in Siberia. During the Second Five-Year Plan, from 1932 to 1937, 17,297,000 acres of land were added to the cultivable area. The program of industrialization of Siberian areas initiated during World War II was accelerated after the end of the war. **SIBERIAN HUSKY**, breed of working dog which originated many centuries ago in that part of northeastern Siberia inhabited by a people known as the Chukchi (q.v.); the dog is sometimes called the Siberian Chuchi. The breed is used in Siberia as a sled dog, watchdog, and pet. In the first decade of the 20th century it was imported into Alaska, where it has since been used as a sled dog and particularly in the sport of sled-team racing; most of the present-day records of this sport in Alaska, Canada, and the United States were set by teams of Siberian huskies, or by teams led by dogs of this breed. In recent years, because of its unusual cleanliness, docility, intelligence, and graceful appearance, the dog has become popular in the U.S. as

a pet. The Siberian husky is a medium-sized dog. The male is from 21 to 23½ in. high at the shoulder and weighs from 35 to 60 lb.; the female is 20 to 22 in. at the shoulder and weighs from 35 to 50 lb. The dog has a double coat; the undercoat consists of soft, thick fur, and the outer coat of soft, smooth hair that gives the dog a well-groomed appearance in contrast to the shagginess of other breeds of sled dogs, such as the Alaskan Malamute and the Eskimo dog (q.v.). The Siberian husky is usually gray, black, or tan; its color is varied by numerous markings, particularly about the head. The dog has a medium-sized, moderately rounded skull; erect ears placed high on the head; eyes brown or blue in color, one eye sometimes being blue and the other brown; a strong, compact body; deep chest; strong, straight legs; and a bushy tail which trails when the animal is inactive and is held up in a sickle curve when the dog is active.

SIBIU (Hung. *Nagyszeben*; Ger. *Hermanstadt*), city of Rumania, in Braşov Region, about 130 miles n.w. of Bucharest. The principal industries include the manufacture of linen and other textiles, alcoholic beverages, soap, candles, rope, leather, and boots. The city is an Orthodox archiepiscopal see and a Lutheran episcopal see, and contains a law college. Among the buildings of historical interest are a 14th-century Gothic church containing a 15th-century mural, and a palace containing a museum and a library of more than 100,000 volumes. Sibiu is of Roman origin, having been founded as the colony of *Libinium*. In the 12th century German settlers from Nuremberg, called "saxons", formed a community in Transylvania and refounded Sibiu as the center of the region. The subsequent history of Sibiu is merged with that of Transylvania (q.v.). After World War I, Sibiu was ceded to Rumania as a result of the peace treaties. In 1940 Sibiu was included in the territory of Northern Transylvania ceded to Hungary by Rumania. The region was restored to Rumania after the close of World War II in 1945. Pop. (1971 est.) 121,394.

SIBYL, in Greek and Roman mythology, any woman inspired with prophetic power by the god Apollo (q.v.). The sibyls lived in caves or near streams, and prophesied in a frenzied trance, usually in Greek hexameters, which were handed down in writing. Early Greek writers mention only one sibyl, probably the Erythraean Herophile, who predicted the Trojan War (q.v.). In later legends, the number of sibyls was increased to ten, including the Samian, the Trojan or Hellespontine, the Phrygian, the Cimmerian, the Delphian, the Cumaeon, the Libyan, the

Siberian husky

Evelyn M. Shafer



SICARII

Tiburtine, and the Babylonian or Persian sibyls. Of these, the most important in Roman mythology was the Cumaean sibyl, Deiphobe. Apollo had promised to grant her anything she wished, and she asked to live for as many years as there were grains of sand in her hand. She did not ask, however, for eternal youth as well, and became so withered that she was hung upside down in a bottle. Her overwhelming desire was to die, the one thing that was not possible for her. In later legend, she guided the Trojan prince Aeneas (q.v.) through the underworld to visit his father Anchises. According to another legend, she appeared in the form of an aged woman before Lucius Tarquinius Superbus (see under **TARQUINIUS**), the seventh and last king of Rome, and offered him nine prophetic books at a high price. When he refused her she destroyed three books and then offered the remaining six at the original price; again Tarquin refused, and she destroyed three more. The king finally bought the remaining three at the price demanded for the nine. These three books were placed in the temple of the god Jupiter (q.v.) in Rome and were consulted in times of great emergency. Although the original Sibylline Books were destroyed in a fire in 83 B.C., a new collection was subsequently compiled. These, however, were destroyed in 405 A.D.

SICARII. See **ZEALOTS**.

SICILIAN VESPER, name given to the massacre, signaled to begin by the first stroke of the

vesper bell, of the French in Sicily on Easter Monday, March 30, 1281. Charles I (q.v.), King of the Two Sicilies, an Angevin (see **ANJOU**), had aroused the hatred of the Sicilians by imposing heavy taxes and especially by putting the island under the control of French officials and soldiers. On that Monday evening the inhabitants of Palermo rose against their oppressors. Their example was followed in other towns, until almost all the French in Sicily had been massacred. Charles made a determined attempt to reconquer the island, but the Sicilians summoned to their aid Pedro III, King of Aragón (1239?-85), who was elected king of Sicily that same year. There followed a long war between the Aragónese and the Angevins for control of Sicily, with the Aragónese ultimately gaining the ascendancy. See **SICILY: History**.

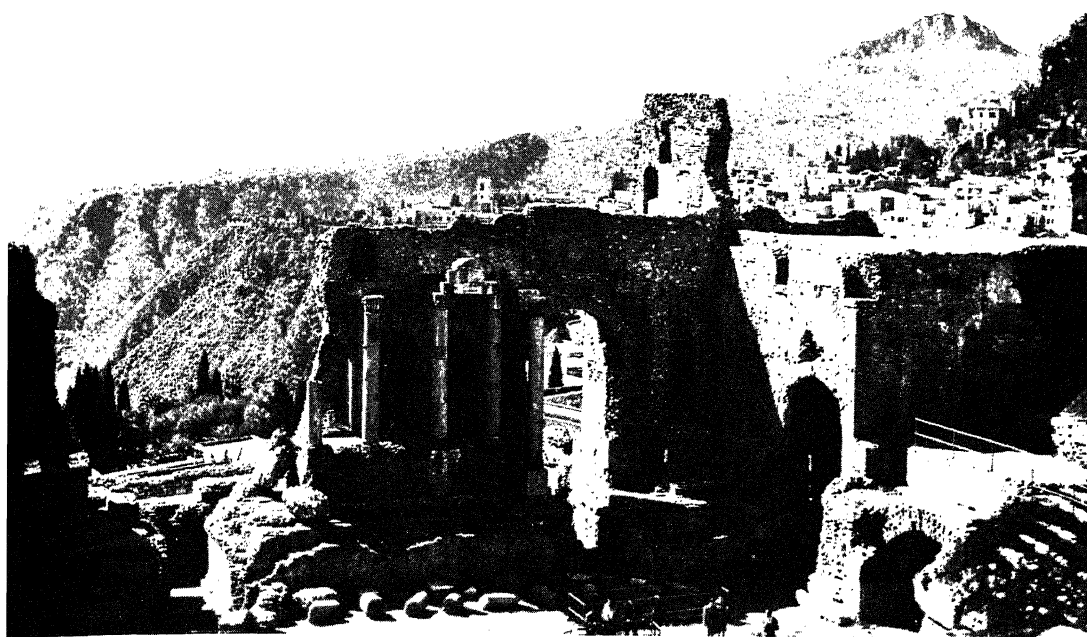
SICILY (It. *Sicilia*; anc. *Trinacria*), largest island in the Mediterranean Sea, lying s.w. of the Italian peninsula, from which it is separated by the narrow Strait of Messina. The island is roughly triangular in shape and has a total area of 9925 sq. mi., including adjacent small islands. Sicily is an autonomous region of Italy; the regional capital is Palermo. Pop. (1971) 4,667,316.

Sicily is for the most part a plateau 500 to 1900 ft. above sea level. In the N. lie the Nebrodi and Madonie Mts., the only well-defined ranges, although there are several isolated peaks, such as the volcano Mt. Etna (11,053 ft.) in the E. and Monte San Giuliano (anc. *Eryx*, 2460 ft.) in the N.W. The lower mountain slopes are generally covered with groves of oranges and olives, and

The Temple of Concordia in Agrigento, Sicily, a superb example of Doric architecture.

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Volcanic Mt. Etna looms over a Greek theater of the 5th century B.C., in Taormina, Sicily. Standard Oil Co. (N.J.)

most of the plateau with fields of wheat. The only extensive plain is that of Catania, from which Etna rises. This region is subject to earthquakes. A shock in 1908 resulted in the loss of more than 50,000 lives in Messina and nearby villages.

Very little rain falls in Sicily and the whole country is subject to constant drought, not much relieved by the oppressive sirocco (q.v.) wind that blows across the island from North Africa. The rainy season occurs in late autumn and winter but does little to improve upon the general dryness.

In the highest mountain regions of Sicily juniper trees can be found; on the lower slopes beeches grow. Plane trees occur along the rivers in the east, and in the still lower flat lands, where wheat is grown, chestnut and oak trees also grow, along with olive trees, cork oak, and pine. Apart from several varieties of vulture, few wild animals are native to Sicily.

Education. See ITALY: *The People: Education.*

Economy. After 1896, Sicily was the principal source of the world supply of sulfur; at present, however, Texas is first in sulfur production. Other minerals mined in Sicily are rock salt and asphalt. The petrochemical industry also figures in the economy of the island and is largely dependent on production in E. Sicily, particularly in Catania and Syracuse and in Ragusa and Gela. Agriculture, mainly using primitive methods, is still the predominant occupation of Sicilians; wheat is the most important crop. Cereal grains are grown on the larger estates in the interior and along the S. coast. Smaller holdings are de-

voted principally to growing grapes, almonds, olives, oranges, lemons, beans, and sumac, used in tanning and dyeing. The fisheries (tunny, sardine, coral, and sponge) are extensive; one fourth of Italy's fishing vessels sail from Sicily. Other occupations include manufacture of wine and olive oil, fruit and vegetable canning, and preparation of citric acid. Some glassware, metalware, and matches are produced in the larger cities. Sicily exports sulfur, fruits and vegetables, sumac, salt, wine, oil, and fish, and imports mainly grain, coal, and iron. Almost the entire trade is seaborne through the three principal ports, Palermo, Catania, and Messina.

HISTORY

Sicily was inhabited at the beginning of historical times by a people called the Siculi or Sicani. It is believed that they crossed over to the island from the southern tip of Italy. The recorded history of Sicily began with the establishment of Greek and Phoenician colonies. The earliest Greek colony, Naxos, was founded in 735 B.C.; the latest, Agrigentum (modern Agrigento), about 580 B.C. Agrigentum and Gela early became prominent; under the rule (570-554 B.C.) of Phalaris, Agrigentum became for a short time probably the most powerful colony in Sicily. Gela, under a succession of able tyrants, such as Gelon (q.v.), forced most of the other Greek cities on the island into subjugation.

The Carthaginians first arrived on the island in 536 B.C., but because of the growing wealth and power of the Greek cities, they were long con-

SICILY

fined to the N.W.; the principal Carthaginian colonies were Panormus, Motya, and Solois. In a battle at Himera in 480 B.C. the Carthaginian army was completely routed by Gelon, and the Carthaginian leader, Hamilcar Barca (q.v.), was slain. The Gelonian dynasty at Syracuse fell in 466 B.C., and for fifty years Sicily had peace. In

under Robert Guiscard (q.v.) and his brother Roger I of Sicily (1031–1101), began the conquest of Sicily, completed in 1090. In 1127 Roger II (q.v.), Count of Sicily, was recognized as duke of Apulia and Calabria, and in 1130 he assumed the title of King of Sicily. The domain of Roger II sometimes was called the Kingdom of the Two



Lemon pickers pause for lunch in one of the many citrus orchards that line the east coast of Sicily.

Standard Oil Co. (N.J.)

410 B.C. war was renewed between Carthaginians and Greeks for possession of the island. The Carthaginians were successful, but the vigorous reign of the tyrant Dionysius the Elder (q.v.) at Syracuse (405–367 B.C.) put a check to Carthaginian conquest. In 246 B.C. Carthaginian Sicily became a Roman province, as did the rest of the island in 210 B.C. The chief events of the Roman history of Sicily were the two insurrections of slaves, in 135–132 B.C. and in 102–99 B.C.; the infamous *propraetorship* of the Roman politician Gaius Verres (d. 43 B.C.) between 74 and 70 B.C.; occupation of the island in 42 B.C. by the Roman soldier Sextus Pompeius Magnus (see *under POMPEIUS*); conquest by the Vandals under Genseric (q.v.) in 440 A.D.; his cession of the island to the Ostrogoth leader Theodoric (q.v.); and recovery by the Byzantine general Belisarius (q.v.) in 535 A.D. for the Byzantine Empire (q.v.).

The year 827 marked the beginning of the Saracen occupation of Sicily. In 1060 the Normans

Sicilies, or the Two Sicilies, because the southern part of the Italian mainland was known as "Sicily on this side of Cape Faro".

The Two Sicilies. In 1194 the Norman rule was succeeded by that of the house of Hohenstaufen, which was overthrown in 1266 by Charles I, Count of Anjou, who became Charles I (q.v.), King of the Two Sicilies. In 1282, after a massacre of French soldiers known as the *Sicilian Vespers* (q.v.), the Kingdom of the Two Sicilies was divided; Naples remained under the control of the House of Anjou, but the island of Sicily became independent and chose as king Pedro III, King of Aragón (1236–85), who was connected by marriage with the house of Hohenstaufen. In 1296 the island was separated from Aragón; for more than a century it was ruled by a branch of the Aragónese dynasty and was then reunited with that kingdom. Ferdinand V (q.v.), King of Castile, made himself master of the Kingdom of Naples in 1503, and the Spanish crown retained both countries until the War of the Spanish Succession (q.v.). By the Treaty of Utrecht (1713) Sicily was separated from Naples and handed over

to Victor Amadeus II, Duke of Savoy (1666–1732), who ceded it to Austria seven years later, receiving in exchange the island of Sardinia.

In 1734 Don Carlos, later Charles III, King of Spain (see under CHARLES), of the house of Bourbon, invaded Naples and Sicily, and in 1735 he was crowned and was recognized by the Treaty of Vienna as Charles IV, King of the Two Sicilies. After the Peace of Aix-la-Chapelle (1748), Italy enjoyed almost fifty years of peace, and in the Two Sicilies progress was made along many lines. The upheaval of the French Revolution brought new troubles. The coalition against the French Republic was joined by Ferdinand I (q.v.), King of the Two Sicilies.

In December, 1798, the Neapolitans attempted to drive the French out of the Papal States. They were thrown back, Naples was taken (January, 1799), and the Parthenopean Republic was created. In the same year Ferdinand was reinstated with the assistance of the British fleet. In 1796 Napoleon I (q.v.) conquered the Kingdom of Naples and placed his brother Joseph Bonaparte (q.v.) on the throne, Ferdinand continuing to reign in Sicily. In 1808 Joseph was succeeded by Joachim Murat (q.v.), King of Naples; after the fall of Murat in 1815, Ferdinand was restored in Naples. At the close of 1816 Ferdinand united the kingdoms of Naples and Sicily into the single Kingdom of the Two Sicilies and changed his title from Ferdinand IV to Ferdinand I. Criminal elements were recruited in the 18th century to protect the interests of landowners. This group organized into a powerful secret society known as the Mafia, that still has considerable influence in Sicily and elsewhere.

In 1820 a military rising took place in the Neapolitan dominions, joined by the revolutionist group called the Carbonari (q.v.), to secure a constitutional government. Ferdinand yielded to the demand, although he had agreed with Austria to make no constitutional concessions. At the same time a revolutionary movement for Sicilian autonomy took place in the island. The congress of the great powers at Laibach (1821) charged Austria to restore Ferdinand's absolute power. Ferdinand was succeeded in 1825 by his son Francis I (see under FRANCIS), who was succeeded by his son Ferdinand II (q.v.) in 1830. After 1843 the republican theories of the Italian patriot Giuseppe Mazzini (q.v.) took a strong hold in southern Italy. At the beginning of 1848 Sicily rose in insurrection and forced Ferdinand II to grant a representative constitution to his subjects. This did not satisfy the Sicilians, however, and they declared Ferdinand deposed. In his Neapolitan dominions, Ferdinand, aided by



A leisurely stroll in Palermo, capital of Sicily.

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reactionary elements, fought successfully against the revolutionary movement then sweeping through Italy. In September, 1848, his forces entered Sicily. In May, 1849, Palermo capitulated, and the revolution in the island ended. Ferdinand inflicted his vengeance upon the rebels, and was only checked finally by the intervention of Great Britain. In 1859 Ferdinand II was succeeded by his son Francis II (see under FRANCIS). After northern Italy was freed from the rule of Austria, the Italian nationalist leader Giuseppe Garibaldi (q.v.) liberated the Two Sicilies from the Bourbons, and Sicily was incorporated into the new Kingdom of Italy (1860–61).

During World War II, on the night of July 9–10, 1943, Sicily was invaded from northern Africa by American, Canadian, and British forces; see WORLD WAR II: *The Invasion of Sicily*. Thirty-eight days later the conquest of the island from the Germans was completed. The Sicilian campaign resulted in the downfall of the Italian government headed by the dictator Benito Mussolini (q.v.) and, a few weeks later, the capitulation of the government headed by Pietro Badoglio (q.v.).

Developments after World War II. Under the constitution of 1948 Sicily became a locally au-

SICKLE-CELL ANEMIA

tonomous region of Italy, with extensive powers of self-government; see *ITALY: History*. A regional council, composed of ninety counselors and directed by a president, are popularly elected.

The process of industrialization has not absorbed the surplus labor force, and there has been large-scale emigration to northern Italy, Germany, Switzerland and, to a lesser degree, North and South America and Australia.

SICKLE-CELL ANEMIA. See *BLOOD: Blood Diseases*. See also *ANEMIA*; *CYTOLOGY*.

SIDDHARTHA. See *BUDDHA*.

SIDDONS, Sarah Kemble (1755–1831), British actress, daughter of the British actor Roger Kemble (see *under KEMBLE*), born SARAH KEMBLE, in Brecknock, Wales. She began her acting career



Sarah Kemble Siddons (painting by the 18th-century English artist Thomas Gainsborough).

British Information Services

in childhood as a member of her father's traveling company. In 1773 she married William Siddons (d. 1808), another member of the company. Her first appearance in London was at the Drury Lane Theatre (q.v.) in 1775, playing Portia in *The Merchant of Venice* by William Shakespeare. For the following seven years she played in provincial theaters. In 1782 she again appeared at the Drury Lane, as Isabella in a version by the British actor David Garrick of *The Fatal Marriage* (1694) by the English dramatist Thomas Southerne (qq.v.). Her performance in this role finally established her in London. She played

chiefly in Shakespearean roles and became known as the greatest English tragic actress of her time.

Her finest role was that of Lady Macbeth in Shakespeare's *Macbeth*; and her farewell appearance took place in this role in 1812. She was the subject of paintings by some of the most famous artists of the time, including the British painters Sir Joshua Reynolds and Thomas Gainsborough (qq.v.).

SIDEREAL CLOCK. See *TIME: Sidereal Time*.

SIDERITE, or **SPATHIC IRON** or **CHALYBITE**, brown, lustrous, translucent or transparent mineral composed essentially of iron carbonate, FeCO_3 . It crystallizes in the rhombohedral system in crystals which show perfect rhombohedral cleavage, or in massive formations; see *CRYSTAL*. The hardness (q.v.) ranges from 3.5 to 4; the specific gravity is 3.83 to 3.88. The mineral becomes strongly magnetic when heated. Siderite is mined as an important ore of iron in England, Scotland, Germany, and Austria. A minor iron ore in the United States, it is abundant in Pennsylvania and Ohio.

SIDI-BEL-ABBÈS, city of Algeria, in Oran Department, about 50 miles s. of the city of Oran. It is in the center of an important agricultural region. The city was noted as the headquarters of a French Foreign Legion regiment. A wall with four gates encircles the city. Pop. (latest est.) 101,000.

SIDI IFNI. See *IFNI*.

SIDNEY, city in Ohio, and county seat of Shelby Co., on the Miami R., about 32 miles N.W. of Springfield. Sidney is in a farm area where livestock and grain are raised. Manufactures include road machinery, household appliances, machine tools, and foundry products. Founded in 1820, Sidney was incorporated in 1834. Pop. (1960) 14,663; (1970) 16,332.

SIDNEY, Algernon or **SYDNEY, Algernon** (1622–83), English political leader, the grand-nephew of the English poet Sir Philip Sidney (q.v.), born in Penshurst, Kent, and privately educated. Although the son of an earl, he supported the Parliamentarians during the Great Rebellion (q.v.) and fought on their side in the Battle of Marston Moor in 1644. He became a member of Parliament in 1645 and was nominated a commissioner for the trial of the English King Charles I (q.v.) held in 1649. Sidney refused to take part in the trial, however. He served as a member of the council of state in 1652 but retired from public affairs in 1653 in protest against the usurpation of power by the English Puritan leader Oliver Cromwell (see *under CROMWELL*). In 1659 Sidney resumed his seat in Parliament and was

again placed on the council of state, carrying out a number of diplomatic missions. After Charles II (q.v.) succeeded to the English throne with the restoration of the monarchy in 1660, Sidney lived in exile on the Continent. In 1677, however, the king pardoned him and permitted his return to England.

Sidney later joined the group of Whig leaders, including James Scott, Duke of Monmouth (q.v.), William, Lord Russell (1639–83), and Arthur Capel, Earl of Essex (1631–83), who reputedly discussed the possibility of overthrowing the monarchy. After the discovery of the so-called Rye House Plot (q.v.), the participants were charged with treason. The trial, which was held before the notoriously brutal lord chief justice, George Jeffreys (q.v.), was conducted in such a manner as to insure a conviction, although little evidence was introduced to establish the guilt of Sidney and his associates. A verdict of guilty was rendered, and Sidney, Essex, and Russell were executed.

SIDNEY, Sir Philip (1554–86), English poet, courtier, and soldier, born in Penshurst, Kent, and educated at the universities of Oxford and Cambridge. A favorite of Elizabeth I (q.v.), Queen of England, he was sent on several diplomatic missions. He retired from court for a time after incurring the queen's displeasure, but in 1583 he was knighted and restored to favor. In 1585 he was appointed governor of Flushing in the Netherlands, and in 1586 he joined an expedition sent to aid the Netherlands against Spain. At the age of thirty-two, Sidney died of wounds received in a raid on a Spanish convoy at Zutphen in the Netherlands.

None of Sidney's works was published during his lifetime. The best known are his *Defence of Poesie* (1595), a critical essay; *Astrophel and Stella* (1591), a sequence of sonnets; and *Arcadia* (1590), a pastoral romance in prose with poems interspersed which became a model for the English pastoral romance. His grandnephew was the English political leader Algernon Sidney (q.v.).

SIDON. See SAIDA.

SIEGBAHN, Karl Manne Georg (1886–), Swedish physicist, born in Örebro, and educated at the University of Lund. He began teaching physics at the University of Lund in 1911 and was appointed professor and chairman of the department of physics in 1920. He held the same position at the University of Uppsala from 1923 to 1937, and afterward served in Stockholm as professor at the Royal Academy of Sciences from 1937 to 1964 and as director of the Nobel Institute for Physics from 1979 to

1964. He is known for his investigations in X-ray spectroscopy (see SPECTRUM), for which he was awarded the 1924 Nobel Prize in physics. His writings include *Spectroscopy of X-Rays* (1925).

SIEGECRAFT. See FORTIFICATION AND SIEGECRAFT.

SIEGFRIED, legendary warrior-hero of German mythology, the most famous chronicle of his life and deeds being the medieval German epic *Nibelungenlied* (q.v.). The son of Siegmund, King of the Netherlands, Siegfried became invulnerable, except for one small patch between his shoulders, by slaying the dragon Fafnir and bathing it in its blood. His subsequent adventures, including his capture of the Nibelungen gold and acquisition of the *tarnkappe*, a cloak that rendered its wearer invisible; his exploits in the service of the Burgundian king Gunther; his marriage to Gunther's sister Kriemhild; and his death at the hands of Hagen, a treacherous councillor at Gunther's court, are described in the *Nibelungenlied*. Siegfried is also the hero of the opera cycle *The Ring of the Nibelung* by the German composer Richard Wagner (q.v.).

SIEMENS, name of distinguished family of German engineers and industrialists.

Werner von Siemens (1816–92), born in Lenthe, near Hannover, the oldest of four brothers, discussed below. He was educated at the military academy in Berlin, and from 1838 to 1849 he served as an artillery officer in the Prussian army. In 1847 he helped found the firm of Siemens & Halske for the manufacture of telegraphic equipment; the firm subsequently also manufactured electrical equipment. Werner von Siemens was largely responsible for the laying, in 1848, of the first German telegraph line. His many electrical inventions and discoveries include the electric dynamo, and the use of gutta-percha, an elastic, rubberlike substance, for insulating cables.

Friedrich Siemens (1826–1904), born near Lübeck. He began working with his brother Wilhelm in England in 1848 and invented a smelting oven used in the manufacture of glass in 1856. He returned to Germany in 1867 to become head of a glassworks company in Dresden.

Karl von Siemens (1829–1906), born near Lübeck. He moved to Saint Petersburg (now Leningrad) in 1853 and formed a Russian branch of Siemens & Halske, which he served as director from 1880 to 1894.

Wilhelm Siemens, later SIR WILLIAM SIEMENS (1842–83), born in Lenthe, and educated at the Magdeburg polytechnical school and the University of Göttingen. He emigrated to England in 1844 and thereafter directed the English branch of the firm of Siemens & Halske. Wil-

SIENA

helm Siemens is most famous for developing the open-hearth furnace, which he patented in 1856 and later applied to the manufacture of steel; see IRON AND STEEL MANUFACTURE: *Open-Hearth Process*. He was also a pioneer in the use of electrical power and one of England's leading authorities on science and engineering. A British citizen from 1859, he was elected a fellow of the Royal Society in 1862 and was knighted in 1883.

Wilhelm von Siemens (1855–1919), son of Werner, born in Berlin. He helped to develop the incandescent lamp and after his father's death took over the directorship of Siemens & Halske.

SIENA, city of Italy, in Tuscany Region, and capital of Siena Province, 60 miles s. of Florence. It is a marketing center for wine and marble produced in the area. Its manufactures include chemicals, fertilizers, and textiles. Terra (or raw) sienna, used as a pigment in paints, is produced in the vicinity. The cathedral is one of the finest examples of Gothic architecture in Italy. The municipal palace, in Gothic style, begun in 1288 and finished in 1309, contains numerous paintings by Siennese artists; see SIENESE SCHOOL. Among the noteworthy public institutions in the city are the University of Siena, with faculties of medicine and law, founded in 1300; the state archives and the town library; and an institute of fine arts, with many fine pictures by masters of the Siennese school, including the brothers Ambrogio Lorenzetti and Pietro Lorenzetti, Simone Martini, Baldassare Peruzzi, Domenico Beccafumi (qq.v.), and Giovanni Antonio de' Bazzi (see SODOMA, IL). Pop. (1971) 65,347.

SIENESE SCHOOL, school of painting, centered in Siena, Italy, which together with the Florentine school dominated Italian painting from the late 13th to the 15th century; see FLORENTINE PAINTING AND SCULPTURE: *Florentine Painting*. Primarily influenced by the Byzantine style, the Siennese school was essentially medieval in the emphasis it gave to flat linear pattern and religious atmosphere; in contrast, the Florentine school inaugurated the Renaissance style through the use of massive form, spatial perspective and naturalistic representation; see BYZANTINE ART: *Painting*; RENAISSANCE ART AND ARCHITECTURE: *Italy*. The Siennese masters enhanced the Byzantine style by giving it a new delicacy and refinement as well as a sweetness and intimacy. The first great Siennese master, generally considered the founder of the school, was Duccio di Buoninsegna (q.v.), who is noted for the poignancy of his figures and for his use of detail to tell a story. His most important sur-

viving work is the "Majestà" ("The Virgin in Majesty"), a large altarpiece painted for the Siena Cathedral between 1308 and 1311. The main panel of the altarpiece is now in the museum of the cathedral. Duccio's best-known follower was Simone Martini (q.v.), who introduced the technique of fresco (q.v.) painting into the Siennese school. In the course of the 14th century the influence of the Florentine painter Giotto (q.v.) became evident in Siennese painting, particularly in the frescoes of Ambrogio and Pietro Lorenzetti (see under LORENZETTI). During the 15th century Siennese painters remained independent of Renaissance influence, and artists such as Stefano di Giovanni, known as Sassetta (about 1400–50), and Giovanni di Paolo (about 1403–83) continued the Siennese tradition of the preceding century in both style and subject matter. After the 15th century no special style can be characterized as distinctly Siennese.

SIENKIEWICZ, Henryk (1846–1916), Polish novelist, born in Wola Okrzejska, near Łuków, Poland, and educated at the University of Warsaw. In 1870 he became a journalist and from 1876 to 1878 traveled through the United States as a special correspondent. Sienkiewicz's great popularity came after the publication of his trilogy on Poland's efforts against invasion in the 17th century. The three volumes appeared separately: *With Fire and Sword* (1884), *The Deluge* (1886), and *Pan Michael* (1888). Probably his most widely read work, *Quo Vadis?*, a study of Roman society in the time of the emperor Nero (q.v.), was published in 1896. It has since been translated into many languages and has been dramatized in the U.S., Great Britain, France, and Germany. Sienkiewicz received the 1905 Nobel Prize in literature.

SIERRA CLUB, nonprofit conservation and outdoors organization, founded in the United States in 1892 by the American explorer and naturalist John Muir (q.v.), dedicated to the exploration and preservation of the nation's wilderness and wildlife. The club sponsors an extensive outings or hiking program throughout the country, as well as public talks, films, and exhibits. It has several publications, including the *Sierra Club Bulletin*, a weekly newsletter and *The National News Report*, and books notable for their color photographs. Headquarters of the club, which has chapters in every State, are in San Francisco, Calif.

SIERRA LEONE, independent nation in w. Africa and a member of the Commonwealth of Nations and of the United Nations. It is bounded on the n. and e. by the Republic of

Guinea, on the s.e. by Liberia, and on the s.w. and w. by the Atlantic Ocean. It is situated between lat. 7° N. and lat. 10° N. and between long. 10°50' W. and long. 13° W. The total area is about 27,925 sq.mi.

THE LAND

From the low coastal plain the land rises gradually to hilly terrain in the s. and to a high plateau and mountains in the n. and n.e. The climate is tropical; the mean annual temperature is about 80° F. Annual rainfall averages more than 150 in. along the coast, diminishing to about 80 in. in the n. Most of the rain falls between May and October.

Natural Resources. Sierra Leone derives much wealth from mineral resources. The world's fourth largest producer of diamonds, the country is also rich in such minerals as chrome, bauxite, iron, and titanium (rutile) ores. Small amounts of gold and platinum are mined.

The natural vegetation comprises grasses, bushes, and such varieties of trees as mahogany, palm, and teak. Among the numerous small animals are bush pigs, chimpanzees, monkeys, porcupines, and tigers. Crocodiles and hippopotami are often found in the rivers.

THE PEOPLE

The population is composed predominantly of Africans belonging to about twenty tribes. The largest tribes are the Bulom, the Mende, and the Temne. Other population groups include the Creoles, descendants of freed slaves returned from the Americas, and small numbers of Lebanese, Indians, and Europeans. The majority of the population live in villages.

The African cultures of Sierra Leone (especially on the coast) have been influenced primarily by English culture and institutions. The inland tribes have tended to preserve their tribal traditions, although influenced by Islamic traditions.

Population. The population of Sierra Leone (1974 est.) was 3,000,000; the United Nations estimated (1974) 2,710,000. The overall population density is 107 per sq.mi. Freetown (q.v.), the capital, has a population (1972 est.) of 200,000. Bo, in the s., is a railroad center and the second largest city of Sierra Leone.

Religion and Language. The majority of the people are animists. Christianity is strongest among the Creoles, and Islam is practiced by the Temne in the n. English is the official language. Of about twenty African languages spoken, Mende and Temne are most widely used. The widespread lingua franca is Krio, a form of pidgin English.

Education. Education is neither free nor compulsory. Private schools charge small fees, but



INDEX TO MAP OF SIERRA LEONE

Cities and Towns

Bauya	.....A 1
Bo	.....B 2
Bonthe	.....A 2
Daru	.....B 2
Freetown (cap.)	.....A 1
Kabala	.....B 1
Kailahun	.....B 1
Kambia	.....A 1
Kenema	.....B 2
Lungi	.....A 1
Magburaka	.....B 1
Makeni	.....A 1
Mano	.....B 1
Marampa	.....A 1
Moyamba	.....A 1
Pendembu	.....B 1
Pepel	.....A 1
Port Loko	.....A 1
Pujehun	.....B 2
Sefadu	.....B 1
Sulima	.....B 2
Yonibana	.....A 1

Physical Features

Banana (isls.)	.....A 1
Bintimane (peak)	.....B 1
Great Scarcies (river)	.....A 1
Jong (river)	.....A 1
Little Scarcies (river)	.....A 1
Loma (mts.)	.....B 1
Mano (river)	.....B 2
Meli (river)	.....B 1
Moa (river)	.....B 2
Mongo (river)	.....B 1
Moro (river)	.....B 2
Rokel (river)	.....A 1
Sewa (river)	.....B 2
Sherbro (isl.)	.....A 2
Sherbro (river)	.....A 2
Sierra Leone (est.)	.....A 1
Turtle (isl.)	.....A 2
Waanje (river)	.....B 2
Yawri (bay)	.....A 2
Yelibuya (isl.)	.....A 1

almost all schools receive government subsidy. In the mid-1970's the enrollment in the more than 1050 primary schools was about 170,000, and some 100 secondary and technical schools were attended by about 35,000. About 700 were enrolled in 6 teacher-training institutions. The University of Sierra Leone, the oldest western university in w. Africa, had an enrollment of some 1100.

THE ECONOMY

The economy of Sierra Leone is based on agriculture and mining. The bulk of the population is engaged in subsistence farming. In the mid-1970's about 140,000 workers received wages or salaries. The government has encouraged foreign investment by granting tax and customs concessions to firms establishing industrial, mining, or agricultural enterprises. In 1975 budget figures showed revenues of about \$73,500,000 and expenditures of about \$72,000,000.

SIERRA LEONE

Agriculture. The staple food crop is rice; in the mid-1970's efforts were made to achieve self-sufficiency in rice production. Other crops grown for internal use include cassava, millet, sorghum, peanuts, and sugar. Such agricultural products as palm kernels, coffee, cocoa, ginger, kola nuts, and piassava (palm fibers) are grown for export. Cattle, goats, and sheep are raised. Fishing provides a major source of protein.

Mining and Manufacturing. In addition to its extensive trade in gem and industrial diamonds, Sierra Leone mines and exports such minerals as iron ore and bauxite. Exploitation of one of the largest deposits of titanium (rutile) ore in the world was begun in 1966.

Manufacturing is limited largely to the processing of such primary products as palm kernels, palm oil, and rice. Light industries, including furniture, textile, cigarette, and cement manufacturing, have been developed. Sierra Leone has a natural oil refinery, which can produce sufficient quantities for domestic needs. Energy is also provided by a hydroelectric complex located near Freetown.

Commerce and Trade. The unit of currency is the leone (.826 leones equal U.S.\$1; 1975), issued by the Bank of Sierra Leone. In the mid-1970's exports were valued at \$143,000,000 annually, and imports totaled about \$223,000,000. Diamonds and iron ore provided about three quarters of the country's export earnings. The remainder was composed of lesser minerals and agricultural commodities. The major imports were machinery, vehicles, foodstuffs, and mineral fuels. Great Britain is the chief trading partner. Other important partners include other members of the Commonwealth, Japan, the Netherlands, and West Germany.

Transportation and Communications. The country's rail system has been de-emphasized and is being phased out in favor of an expanded road network. There are more than 5100 mi. of roads. Inland waterways, most of them navigable for three months of the year, total some 500 mi. Freetown and Pepel are the chief ports. The country has a well-developed internal air transport network; international service is provided by Sierra Leone Airways and several foreign lines. Lungi, near Freetown, is the international airport. A radio broadcasting system, based in Freetown, broadcasts in English, Krio, Mende, and Temne. A government-owned television station was established in Freetown in 1963. There is a variety of daily newspapers and other periodicals.

GOVERNMENT

Sierra Leone is a republic within the Common-

wealth of Nations. A president is chief executive of the country. He is elected to serve for five years and is assisted by a vice-president, a prime minister, and a cabinet. No more than three ministers may be appointed from outside the House of Representatives. The military consists of an infantry battalion and headquarters of some 1500, and a navy of 150. Police forces number about 2100.

Health and Welfare. The government in conjunction with the World Health Organization conducts campaigns against leprosy, sleeping sickness, and yaws. A system of hospitals, dispensaries, and health centers is also operated by the government. No state social security system exists.

Legislature. Legislative authority lies with the House of Representatives consisting of not less than 60 members, elected by universal suffrage; 12 paramount chiefs chosen by district tribal councils; and 3 presidential appointees. It is headed by a speaker.

Political Divisions and Local Government. Sierra Leone is divided into four regions: the Northern, Eastern, and Southern provinces, and the Western Area. These are divided into districts, each having a resident minister. The districts are subdivided into chiefdoms, each controlled by a paramount chief and a council of elders, who are responsible for maintaining law and order and administering justice.

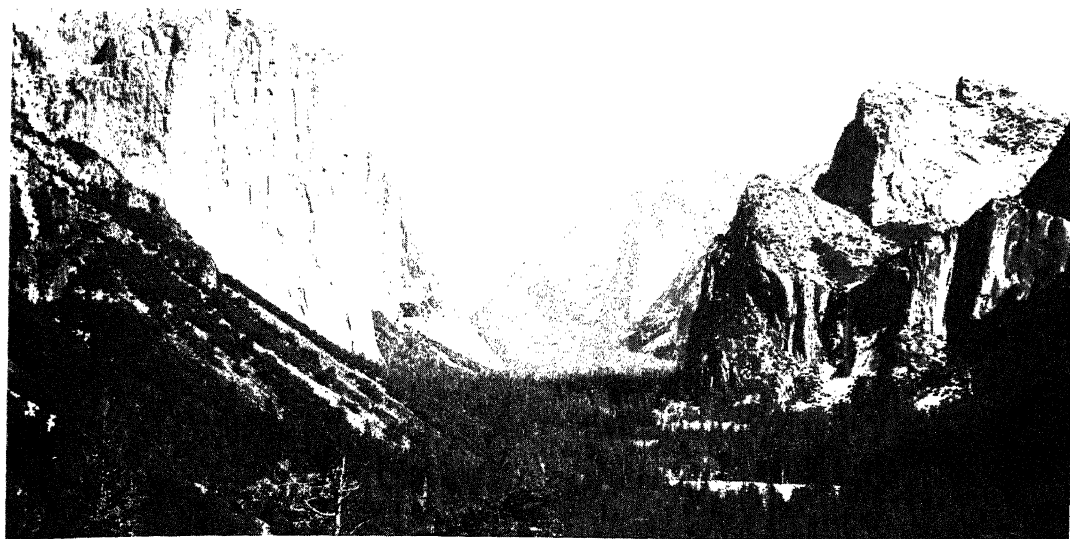
Judiciary. The judicial system is based on the common law of England. The court system includes the court of appeal, the supreme court, magistrates' courts, and native courts. Magistrates' courts have jurisdiction in civil cases, and native courts decide cases involving native law and customs. Appeals are made to the court of appeal and ultimately to the supreme courts.

HISTORY

The country was named Sierra Leone (Lion Mountains) by the Portuguese explorer Pedro da Cintra, who visited the coast in 1460.

The British established the colony of Sierra Leone in 1787 for the purpose of providing a home for slaves repatriated from England and the United States and for slaves rescued from slave ships; see SLAVERY. The land of the original settlement, where Freetown later developed, was purchased from local chiefs.

The Sierra Leone Company, formed in 1791, administered the settlement until 1808, when it became a crown colony. Great Britain set up a protectorate over the hinterland of Sierra Leone in 1896. The first elections for the legislative council were held under the constitution of 1924. The ministerial system was introduced in



A range of the Sierra Nevada in the vicinity of Yosemite National Park.
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1953, and Sir Milton Margai (1895–1964), a former physician and leader of the Sierra Leone People's Party, was appointed chief minister in 1954 and prime minister in 1960.

Independence. Sierra Leone became an independent nation in 1961. The constitution of 1961 extended the franchise to women. Following the elections of 1962, Margai remained prime minister. In 1967, as a result of disputed elections, in which Siaka Stevens (1905–), leader of the All People's Congress (APC) Party, was elected prime minister, the army staged a coup and organized a National Reformation Council. After a second army revolt in 1968, civilian government was restored, and Stevens was returned to power. Sierra Leone was declared a republic on April 19, 1971, with Stevens sworn in as executive president on April 21. Opposition to the government was gradually eliminated, and in elections held in May, 1973, the APC was unopposed and Stevens was reelected president. Sierra Leone joined other African nations in signing a trade and aid agreement with the European Economic Community in early 1975. In mid-1975 it helped form the Economic Community of West African States.

SIERRA MADRE, two mountain ranges in Mexico, the Sierra Madre Occidental and the Sierra Madre Oriental, enclosing the central plateau of Anáhuac. The Occidental is a more continuous range than the Oriental; it has an average altitude of 8000 ft., and contains numerous deep canyons. Its highest points are the Nevado de Colima (14,240 ft.) and Volcán de Colima (12,631 ft.). In the Oriental range occur Citlaltépetl (18,855 ft.), Popocatepetl (17,887 ft.), and other volcanoes.

SIERRA NEVADA, major range of mountains contained completely in California except for a

small portion at Lake Tahoe, which is partially in Nevada. The range extends from N.W. to S.E. for approximately 400 mi. and varies in width from 40 to 80 mi. It is bounded on the N. by a gap S. of Lassen Peak and by the Cascade Range (q.v.), and on the S. by Tehachapi Pass. The tallest peak in the range is Mt. Whitney (14,494 ft. above sea level), which is also the tallest peak in the continental United States. The W. part of the S.E. portion of the range is called the High Sierra. It consists of a region with an elevation between 6000 and 12,000 ft. above sea level, and peaks which reach elevations 2000 ft. higher. Mount Whitney is one of the peaks; others include Williamson (14,375), North Palisade (14,242), Russell (14,086), Middle Palisade (14,040), Langley (14,028), and Tyndall (14,018).

The Sierra Nevada is composed, geologically, of one unit, a single block of the earth's crust tilted upward toward the E. Granite, other igneous rocks, and metamorphic slate are the principal rocks of the range. The slopes of the range are covered with great forests. Gold embedded in quartz is found in large quantities and silver mines have been opened on the E. side. A number of national forests and parks are situated in the Sierras, including Sequoia National Park, Yosemite National Park (qq.v.), and the Sequoia, Tahoe, and Sierra national forests. See also **DONNER PARTY**.

SIERRA NEVADA, mountain range in S. Spain. See **SPAIN: The Land**.

SIEYÈS, Emmanuel Joseph (1748–1836), French statesman, born in Fréjus, and educated for the clergy in Paris. He became a priest in 1773. Sieyès attracted attention in the early days of the French Revolution (q.v.) with a pamphlet,

SIGHT

Qu'est-ce que le Tiers Etat? ("What is the Third Estate?", 1789). By being cautious, moderate, and usually noncommittal, he remained a figure of some influence through all the stages of the Revolution. He was a member of the States-General (1789), the National Convention (1792–95), the Council of Five Hundred (1795–99), and the Directory (1799), and was one of those who brought the army officer Napoléon Bonaparte, later Napoleon I (q.v.), Emperor of France, to power. Together with the French statesman Pierre Roger Ducos (1747–1816) and Bonaparte, he became a member of the Consulate (q.v.) in 1799. Sieyès framed a national constitution for the regime of Bonaparte, but Bonaparte greatly revised it, and Sieyès subsequently resigned. After Napoleon's downfall, Sieyès was exiled in 1815 but returned to France in 1830.

SIGHT, one of the five special senses (q.v.) in man, birds, and animals by which objects and colors are perceived; see COLOR. This is accomplished by the rods and cones of the retina, a layer of nerve cells that is the internal membrane of the eye; when stimulated by light the retina transmits impulses to the brain via the optic nerves. See EYE; NERVOUS SYSTEM: *Anatomy and Function*; VISION.

SIGISMUND (1368–1437), Holy Roman Emperor (1411–37) and King of Hungary (1387–1437) and Bohemia (1419–37), the son of Charles IV, Holy Roman Emperor (1316–78). In 1385 he married Mary, Queen of Hungary (1370–95), thus acceding to the throne of Hungary two years later. In 1396 he led a great army of Crusaders from many parts of Europe against the Turks; the latter, under the Ottoman sultan Bajazet I (see under BAJAZET), inflicted a crushing defeat upon Sigismund's forces at Nicopolis (now Nikopol), Bulgaria. Upon the death of Rupert, Holy Roman Emperor (1352–1410), Sigismund was elected to succeed him but he did not receive formal coronation at the hands of the pope until 1433. In 1414 Sigismund persuaded the antipope John XXIII (see under JOHN) to convoke the Council of Constance at which the dispute over the papal succession was settled and ecclesiastical reforms were instituted; see CONSTANCE, COUNCIL OF; SCHISM, WESTERN. The council also tried the Bohemian religious reformer John Huss (q.v.) and condemned and executed him as a heretic. Sigismund succeeded to the throne of Bohemia in 1419. His power in Bohemia was never more than nominal, however, as the Bohemians believed him guilty of complicity in the death of Huss, and repeatedly rose in arms against him; see HUSSITE WARS.

SIGNALING. See INTERNATIONAL CODE OF SIGNALS.

SIGN LANGUAGE, organized system of gestures or pantomime (q.v.) used in place of speech among persons lacking a common spoken language, or among persons physically incapable of speech or hearing. See LANGUAGE: *The Origin of Language*.

One of the best-known sign languages is that developed by the Plains Indians (q.v.) of North America as a means of communication between tribes that did not share the same language. In many respects it forms a manual counterpart to the Indian system of pictographs painted on buckskin or birchbark. The manual signs represent things in nature, ideas, emotions, and sensations. For example, the sign for white man is made by drawing the fingers across the forehead, indicating a hat; special signs exist also for Indian, for each Indian tribe, and for particular rivers, mountains, and other natural features. The sensation of cold is indicated by a shivering motion of the hands in front of the body; by extension the same sign is used for winter and also for year, since Indians counted years in terms of winters. Slowly turning the hand, relaxed at the wrist, indicates vacillation, doubt, or possibility; a modification of this sign, with quicker movement, is the question sign. Strong and strength are indicated by the motion of breaking a stout stick; bad, by a motion of contemptuously throwing something away. Song and singing are indicated by a circling movement of the fingers close to the side of the head, to indicate the shaking of the rattle used to accompany Indian songs; since songs and rattles are used in religious ceremonies and in medical conjurations, the same sign may also mean sacred, religion, doctor, or medicine, according to the context. The Indian sign language is so elaborate that a detailed conversation is possible using gestures alone. Organized sign language occurs in many parts of the world besides North America, notably among various tribes of the State of Assam, in eastern India, and of Australia.

Systems of manual gesture employed by deaf and dumb persons generally include two types of signs: natural signs, which stand for ideas or objects and are similar to the signs discussed above; and methodical or systematic signs, which are used for word-by-word or letter-by-letter renderings of the written rather than the spoken language. See DEAFNESS.

In 1970 experiments in sign language were conducted at the University of Nevada with a female chimpanzee. The animal learned to comprehend several hundred gestural symbols and

to make eighty-five signs herself. These results suggested to some anthropologists that abstract thinking and verbal symbolization were abilities inherent in creatures that were ancestral to both chimpanzees and man. See **ANIMAL PSYCHOLOGY**; **PSYCHOLOGY, EXPERIMENTAL**: *Learning*.

SIGNORELLI, Luca, in full **LUCA D'EGIDIO DI VENTURA DE' SIGNORELLI**, also called **LUCA DA CORTONA** (1441?-1523), Italian painter, born in Cortona. An important painter of the early Renaissance, he was influenced by the Umbrian school. He was greatly interested in anatomy and perspective, and his paintings are characterized by a masterful portrayal of the nude in action. His masterpieces are the frescoes in the cathedral of Orvieto, Italy, which were begun in 1499 and completed in 1504.

SIKHS, followers of the Sikh religion, centered in Punjab State, N.W. India. Sikhism is an ethical monotheism fusing elements of Hinduism and Islam (q.v.). It was founded by the 15th-century mystic Nanak, who believed that God transcends religious distinctions.

Beliefs and Practices. Influenced by the devotional emphasis of Bhakti Hinduism and Sufi Islam, Sikhism stresses the unity, truth, and creativity of a personal God and urges union with him through meditation on his title, the Name (*Nam*), and surrender to his will. It also advocates active service rather than the Hindu ideal of ascetic withdrawal. Loyalty and justice are admired, smoking and intoxicants forbidden. Sikhism also rejects the Hindu caste system, priesthood, image worship, and pilgrimage, although it retains the Hindu doctrines of transmigration and karma. The ultimate spiritual authority is the Granth, consisting of hymns by the ten Sikh gurus (Hindi, "teachers") and Hindu and Muslim devotional poetry in several languages. All Sikhs may read the Granth, which is the focus of devotion at the Golden Temple in Amritsar (q.v.), the Sikh religious center.

Sikh males are expected to join the *Khalsa* (Punjabi, "pure"), a religious and military brotherhood. Initiates are "baptized" by drinking sweetened water stirred with a dagger and take the surname Singh ("lion"). They must observe the five k's: no cutting of the beard or hair (*kes*) and the wearing of soldiers' shorts (*kacch*), an iron bangle (*kara*) against evil, a steel dagger (*khanda*), and a comb (*khanga*).

History. Nanak, the saintly first guru, wandered over India seeking converts. He was succeeded by nine gurus whose office became hereditary. The fourth, Ram Das, founded the Golden Temple in the 16th century. The fifth, Arjun, compiled the Granth in 1604. As the Sikhs

became a distinct religious community, they took up arms against persecution by Hindus and by Muslim rulers of the Mogul Empire. Opposing Mogul tyranny, the tenth guru, Gobind Singh, formed the Khalsa in 1699. During the decline of the Moguls the Sikhs, led by the warrior Ranjit Singh, created a powerful state in the Punjab about 1800 that eventually threatened British-controlled India. After internal dissension and two wars the Punjab was annexed by the British raj in 1849.

The British governed the Sikhs fairly and, in return for their loyalty during the Indian Mutiny of 1857, gave them preferential land grants. The Sikhs gained wealth and a great reputation as soldiers and policemen. Upon independence in 1947, they lost their privileges and found their state divided between India and Pakistan. After a bitter war against the Muslims in 1965, the Pakistani Sikhs migrated to India. In response to years of agitation the Indian government created Punjab as a single Punjabi-speaking state in 1966. It is the home of most of the 10,000,000 Sikhs in India. See also **PUNJAB**. P.P.

SI KIANG, or **WEST RIVER**, chief river of S. China. It rises in Yunnan Province and flows through Kwangsi and Kwangtung for 1250 mi. to the South China Sea. It receives many tributaries, the most important being the Kwei R.

SIKKIM, State of the Republic of India, in the N.E. part of the subcontinent of India, on the S. slopes of the Himalaya Mts. Sikkim is bounded on the N. and N.E. by Tibet Autonomous Region of the People's Republic of China, on the S.E. by Bhutan, on the S. by the Indian State of West Bengal, and on the W. by Nepal. It extends approximately from lat. 27° N. to lat. 28° N. and from long. 88° E. to long. 89° E. The area is about 2800 sq.mi.

One of the highest areas in India, Sikkim is traversed by the main range of the Himalayas, and by several spur ranges. The State dominates the Chumbi Valley, a strategic gap in the mountain wall between Tibet and N.E. India. Kanchenjunga (28,208 ft.) is the third-highest peak in the world. Elevations as low as 1000 ft. occur in S. Sikkim. The climate ranges from tropical to alpine. About one third of Sikkim is covered by forests.

The population (census 1971) was 208,609. The capital and chief city is Gangtok (pop. 1971 est., 15,000). The population is mainly Nepalese; Bhutias, a people of Tibetan origin, form the largest minority group. Sikkimese and Nepali are the principal languages, and Tibetan Buddhism is the regional religion. Agriculture forms the basis of the economy; cardamom, oranges, ap-



View of Gangtok, chief town of Sikkim. The building on the top of the hill is a Buddhist monastery. UPI

ples, and potatoes are grown for export. Tourism is a growing industry.

Sikkim was a hereditary monarchy, ruled by a chogyal (maharaja). The last such ruler was Palden Thondup Namgyal (1923–), who succeeded to the throne in 1963. Under a treaty with India in 1950, Sikkim received full internal autonomy. Political unrest in the early 1970's, however, caused the chogyal to request Indian troops to restore order in April, 1973. New Delhi sent troops and a permanent chief administrator for the protectorate. A month later, the chogyal, leaders of the political opposition, and India signed an agreement providing Sikkim with more democratic government and guaranteeing protection for minority groups. Unrest continued; a referendum for the end of the monarchy was approved in 1975, and Sikkim became an Indian State.

SIKORSKY, Igor Ivan (1889–1972), Russian-born American aeronautical engineer and manufacturer, born in Kiev, and educated at the naval college in Saint Petersburg (now Leningrad). He took advanced study courses in engineering in Kiev and later in Paris, France. At first he experimented in helicopter (q.v.) design. In 1913 he designed, built, and flew the first successful multiengine airplane. Later he built military aircraft for Russia and France.

Sikorsky moved to the United States in 1919 and four years later helped organize an aircraft

company which, in 1928, became a division of the United Aircraft Corporation. In the same year, Sikorsky became an American citizen.

With Sikorsky as engineering manager, the company produced a series of multiengine flying boats for commercial service. In the late 1930's Sikorsky returned to developing helicopters and produced the first successful helicopter in the Western Hemisphere. Sikorsky-designed helicopters were used exclusively by the U.S. Army Air Forces during World War II. The Korean and Vietnam conflicts saw a greatly expanded use of the helicopter in airlifting men and supplies, in rescuing pilots downed in enemy territory, and in many other tasks.

SILAGE, or **ENSILAGE**, in green fodder, material generally preserved and stored by farmers to provide nutritious feedstuff for the livestock in the winter; see **AGRICULTURE: Animal Husbandry**. The large, round, brick or metal silage-storage towerlike container commonly found on farms in the United States is known as a silo. Originally, corn, sorghum, and sunflower (qq.v.) were staple silage crops in the U.S. but these have been replaced by the more proteinous alfalfa.

The preservation of silage depends on the controlled fermentation (q.v.) of the green forage in the silo, and a precise regulation of air supply and temperature is of great importance for the production of the most nutritious feed. A number of nutrients, such as starches and sugars, might be added during fermentation, both to accelerate the process and to increase the

nutritive value of the feeds. The silos are generally considered to be the most efficient type for ensuring a tightly packed mass in which the circulation of air and the moisture content can be strictly controlled. Two less efficient types of silage containers are the trench silo, which is simply a concrete-lined excavation in the soil, and the bunker silo, a brick or wood chamber built above ground.

SILENUS, in Greek mythology, oldest of the Satyrs (q.v.), the son of Hermes, messenger of the gods, or of Pan (qq.v.), a woodland god. The tutor of the young god Dionysus (q.v.), Silenus often accompanied him on his travels. The old satyr was usually drunk, and he could be compelled, if caught in a drunken sleep, to prophesy the future. As a reward for his hospitality to Silenus, Dionysus granted Midas (q.v.), King of Phrygia, the golden touch. In art Silenus is represented as a little old man in a state of jovial intoxication.

SILESIA. 1. Former Prussian province, divided in 1919 into the provinces of Upper Silesia and Lower Silesia, and now largely a part of Poland. A remnant of Lower Silesia was made a part of the East German State of Saxony (q.v.; now Karl-Marx-Stadt [q.v.] District). Area, about 20,000 sq.mi.

2. Former province of Czechoslovakia, formed in 1919 from an Austro-Hungarian crownland and a small part of Upper Silesia. The province was united with Moravia to form (1927–49) the province of Moravia and Silesia (q.v.). Silesia was ceded to Germany by terms of the Munich Pact (q.v.) in 1938. It was returned to Czechoslovakia in 1945 and made part of the region of Severomoravský (North Moravia) in 1960. Area, 2132 sq.mi.

3. Historic region of Poland, formed from a small section of Austria and most of Upper Silesia. The German lands were transferred to Poland by a plebiscite (1921) and a League of Nations (q.v.) partition (1922). In 1939 the region was annexed by Germany, but in 1945 Poland regained the Upper Silesian territory and occupied most of Lower Silesia. The region now comprises the Polish provinces of Wrocław, Opole, and Katowice, and part of Zielona Góra. Area, about 17,000 sq.mi.

SILHOUETTE, profile drawing of a portrait, in which the outlines are filled in in black, showing the profile as if cast by the shadow of a strong light. The term is used in a larger sense for every shadow picture, for example, the silhouette of a city, commonly called a skyline, or that of a mountain range. It became customary to cut the silhouette out of black paper and glue

it to a white background. Augustin Amant Constant Fidèle Edouart (1769–1821), a Frenchman who worked most of his life in England and Scotland, was the most prominent artist in this field in the 19th century.

SILICA. See QUARTZ; SILICON.

SILICA GEL. See SILICON.

SILICEOUS ROCKS, group of sedimentary rocks (q.v.) characteristically having quartz (q.v.) as the principal constituent. Sandstone, quartz conglomerate, arkose, novaculite, and chert (q.v.) are the chief varieties of siliceous rocks. See SILICON.

SILICON, nonmetallic element, chemically analogous to carbon, with at.no. 14, at.wt. 28.09, b.p. estimated above 2300° C. (4172° F.), m.p. about 1430° C. (2606° F.), sp.gr. 2.4, and symbol Si. It was first isolated from its compounds in 1823 by the Swedish chemist Baron Jöns Jakob Berzelius (q.v.). With the exception of oxygen it is the most abundant and widely distributed of all the elements and constitutes about 28 percent of the crust of the earth. It does not occur in the free, elemental state, but is found in the form of silicon dioxide or silica, SiO₂, and in the form of complex silicates. Silicon-containing minerals constitute nearly 40 percent of all common minerals, including over 90 percent of igneous rock-forming minerals. The mineral quartz (q.v.) and varieties of quartz, such as carnelian, chrysoprase, onyx, flint, and jasper, and the minerals cristobalite and tridymite are the naturally occurring crystal forms of silica. Silicon dioxide is the principal constituent of sand. The silicates, such as the complex aluminum, calcium, and magnesium silicates, are the chief constituents of clays, soils, and rocks in the form of feldspars, amphiboles, pyroxenes, micas, and zeolites, and of semiprecious stones, such as olivine, garnet, zircon, topaz, and tourmaline.

Properties. Silicon is prepared as a brown, amorphous powder or as gray-black crystals. It is obtained by heating silica with a reducing agent, such as carbon or magnesium, in an electric furnace. Crystalline silicon has a hardness of 7, compared to 5–7 for glass. Silicon is not attacked by nitric, hydrochloric, or sulfuric acids, but dissolves in hydrofluoric acid, forming the gas, silicon tetrafluoride, SiF₄; see FLUORINE. It dissolves in sodium hydroxide, forming sodium silicate and hydrogen gas. At ordinary temperatures silicon is impervious to air but at high temperatures it reacts with oxygen, forming a layer of silica that does not react further. At high temperatures it also reacts with nitrogen and chlorine to form silicon nitride and silicon chloride, respectively.

SILICON

Applications. Silicon is used in the steel industry as a constituent of silicon-steel alloys. The addition of small amounts of silicon makes steel more fusible and more resistant to wear; ordinary steel contains less than 0.03 percent of silicon. Silicon steel, which contains from 2.5 to 4 percent silicon, is used in making the cores of electrical transformers because the alloy exhibits low hysteresis; see **MAGNETISM: Magnetic Circuits**. A steel alloy containing about 15 percent silicon, known as duriron, is hard, brittle, and extremely resistant to corrosion; duriron is used in equipment that comes in contact with corrosive chemicals in industrial plants. Silicon is also used as an alloy in copper, brass, and bronze.

Silicon is an electronic conducting material, known as a semiconductor, in which the resistivity to the flow of electricity at room temperature is in the range between that of metals and insulators. At higher temperatures silicon becomes a conductor, and this property is utilized for temperature measurement in a device called a thermistor. Silicon is used also in the electronic device called the transistor (q.v.).

Silica and silicates are used in the manufacture of glass, glazes, enamels, cement, and porcelain, and have important individual applications. Fused silica, a glass made by melting quartz or hydrolyzing silicon tetrachloride, is characterized by a low coefficient of expansion and high resistance to most other chemicals. Silica gel is a colorless, porous, amorphous substance, prepared by removing part of the water from a gelatinous precipitate of silicic acid, $\text{SiO}_2 \cdot \text{H}_2\text{O}$, which is formed by adding hydrochloric acid to a solution of sodium silicate. Silica gel absorbs water and other substances and is used as a drying and decolorizing agent.

Sodium silicate, Na_2SiO_3 , is an important synthetic silicate. It is a colorless, water-soluble amorphous solid, with m.p. 1088°C . (1990°F .), which is prepared by reacting silica (sand) and sodium carbonate at a high temperature or by heating sand with concentrated sodium hydroxide under pressure. The aqueous solution of sodium silicate, called water glass, is used for preserving eggs, as a substitute for glue in making boxes and other containers, as a binder in artificial gemstones, as a fireproofing agent, and as a binder and filler in soaps and cleansers. Another important silicon compound is the silicon-carbon compound carborundum, which is used as an abrasive.

Silicon monoxide, SiO , is used as a coating to protect other materials, the outer surface oxidizing to the dioxide SiO_2 . Such layers are applied

also as components of interference filters; see **OPTICS: Interference of Light**. N.J.K. & S.Z.L.

SILICONES, in chemistry, valuable silicon-containing organic compounds that were developed during World War II. They are made in various forms that have the physical properties of oils, resins, or rubber, and are extremely useful because they are more stable toward heat and oxygen than the ordinary organic substances. Each molecule of a silicone is a chain composed of alternate silicon and oxygen atoms with an organic group, such as a methyl group, attached to the silicon atom. In preparing a methyl silicone, methyl chloride is combined with silicon alloyed with a small amount of copper to catalyze the reaction. The product of the reaction, dimethylsilicon dichloride, is treated with water, resulting in the formation of silicone molecules. Silicone oils have a comparatively small number of silicon atoms in each molecule; silicone resins and rubbers have larger molecules that are polymerized.

Uses. By controlling the size of the individual molecules and the polymerization of adjacent molecules, oils, resins, or rubbers are produced. Silicone oils can withstand very high temperatures without decomposing and are chemically inert to metals and most reagents. They also remain satisfactorily viscous at the extremely low temperatures at which ordinary hydrocarbon oils become stiff, and at high temperatures at which ordinary oils become too thin. They are used in the hydraulic systems of airplanes. Silicone resins are used as heat-resistant insulators. Silicone rubbers are used as insulators and for other purposes for which rubber is needed at high temperatures. Silicones are also used for waterproofing ceramics, fabrics, and paper. The substance to be treated is first covered with a layer of water, and then exposed to dimethylsilicon dichloride vapor, forming a surface layer of silicone molecules. Silicone prosthetic devices are widely used as parts of implanted organs, as in surgical operations involving the heart, eyes, or Fallopian tubes. Silicone tubing is used to connect artificial kidney machines to the blood vessels of patients. Silicones can be sterilized by heat without being damaged, and they do not react with natural tissues.

See also **CHEMICAL COMPOUNDS, SYNTHETIC: Plastics and Elastomers**; **PLASTICS**. N.J.K. & S.Z.L.

SILICOSIS, chronic disease of the lungs caused by prolonged inhalation of silica dust; see **SILICON**. It is strictly an occupational disease, affecting those employed in mining, stone cutting, metal grinding, and similar industries. The dust causes fibrous nodules to form in the

lungs. The nodules may spread so that massive areas of fibrous tissue replace the normal lung tissue, causing difficulty in breathing, chest pain, and coughing. Individuals with silicosis are more prone to develop tuberculosis (q.v.) than other persons. No treatment exists for silicosis, but it can be prevented by reducing the amount of dust inhaled; compare ANTHRACOSIS. See also OCCUPATIONAL DISEASES.

SILK, fiber produced as a cocoon covering by the silkworm, and valuable for its use in fine fabrics and textiles. The silkworm, in fact, is not a worm but a caterpillar with eyes and legs which worms do not have. Although cocoon coverings of fiber are made by a large number of insects, it is only those of the mulberry silk moth, *Bombyx mori*, and a very few other moths closely akin to it, that are used by the silk industry. The silk of other insects, notably the spider (q.v.), are used for certain manufacturing purposes, particularly for the cross hairs of telescopes and other optical instruments. The life and habits of the silk moth are described in the article SILKWORM.

History. Silk is one of the oldest textile fibers known to man, and, according to Chinese tradition, was used as long ago as the 27th century B.C. The silkworm moth was originally a native of China and for about thirty centuries the gathering and weaving of silk was a secret process, known only to the Chinese. It is said that the discoverer of the potential of the cocoon and the inventor of the first silk reel was Hsi-ling-shi, the fourteen-year-old bride of the Emperor Huang-ti (r. about 2640 B.C.). For nearly 3000 years China successfully guarded the secret, but in 300 A.D. Japan penetrated the secrecy and later, India.

References in the Old Testament indicate that silk was known in Biblical times in western Asia, whence it was presumably transplanted to the Greek islands of the Aegean Sea. It is believed that the Chinese built up a lucrative trade with the West from the days of the Han Dynasty (see HAN) in the 2nd century B.C. The ancient Persian courts used Chinese silks, unravelled and reweven into Persian designs. When Darius III (see under DARIUS), King of Persia, surrendered to Alexander III (q.v.), King of Macedonia, called Alexander the Great, he was clothed in such silken splendor that Alexander was completely overshadowed and demanded as spoils the equivalent of \$7,000,000 in silk. Caravans carried silk on camelback from the heart of Asia to Damascus, Syria, the marketplace at which East and West met. Here silk was traded for Western luxuries, some of which survive in China today. Silk

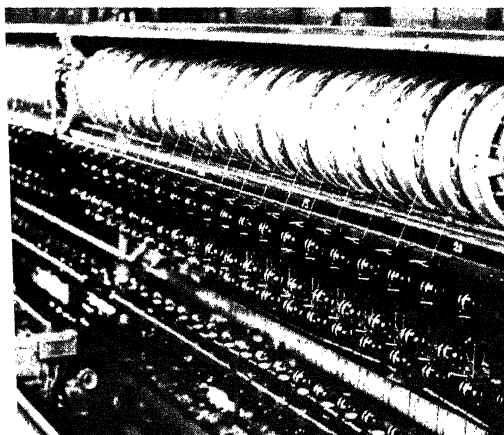
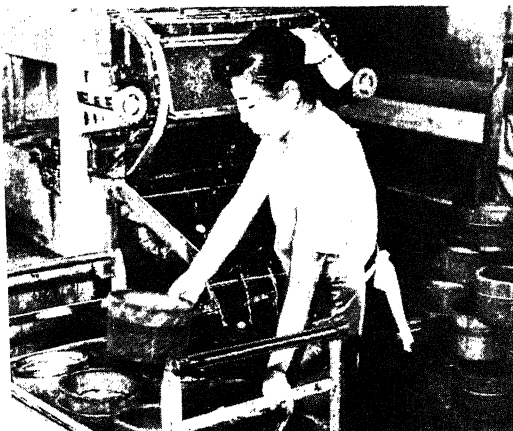
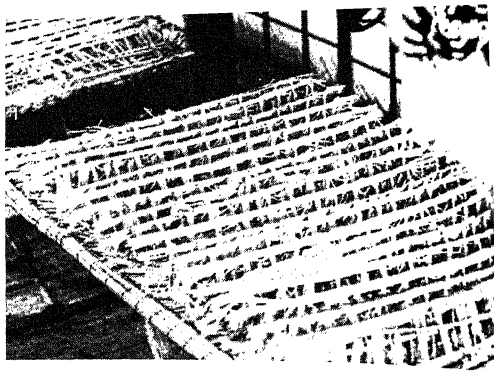
became a valuable commodity both in Greece and in Rome. The Roman statesman and general Gaius Julius Caesar (q.v.) passed an edict restricting silk to his exclusive use and to the purple Roman stripes on the togas of officials he favored. In spite of this, however, the use of silk in Rome spread in the era of pomp and display.

Until the year 550 A.D. all the silk woven in Europe was derived from Asiatic sources. About that time, however, the Roman emperor Justinian I (q.v.) sent two Nestorian monks to China, where, at the risk of their lives, they stole mulberry seeds and silkworm eggs, secreted them in their walking staffs and brought them to Byzantium. Thus the Chinese and Persian silk monopolies ended. With the spread of Islam the silkworm came to Sicily and Spain. By the 12th and 13th centuries Italy had become the silk center of the West, but by the 17th century France was challenging the leadership of Italy and the silk looms then established in the Lyons area are still famous today for the unique beauty of their weaving.

It was not until after the revocation of the Edict of Nantes (q.v.) that Huguenot weavers from France crossed the English Channel and established silk mills in Spitalfields, a district in the East End of London. The silkworm, however, did not flourish in the English climate, nor has it ever flourished in the United States. The first silk mill in America was erected in 1810. With the advent of the power loom, and with the help of the high tariffs introduced during the American Civil War against imported woven goods, the American silk weaving industry entered a period of growth. It was only in China and Japan, however, and to a lesser extent in Italy and France, that the silk itself was produced.

In addition to the true silk from the cultivated mulberry silkworm, there are a number of so-called wild silks produced from other related species of insects in the uncultivated state. Tus-sah silk, for instance, is produced from a species that feeds on oak leaves. Douppion is a silk produced from two silkworms who spin a cocoon together and thus produce a double thread. Special types of weaves, such as shantung and other irregular types, are woven from these types of silk.

Production. The advent of synthetic fibers such as nylon (q.v.) and polyester, which are stronger than silk and lower in price, although not possessing the same hand, or quality, has caused a tremendous reduction in silk production and consumption. World production in 1940 was 130,000,000 lb. By 1950 it had dropped



Steps in the manufacture of silk. Top, left: Silkworms feed on mulberry leaves. Top, right: After six weeks the silkworms spin cocoons and are placed in beds of straw. Center, left: The cocoons are boiled to release the ends of threads. Center, right: Skeins are made from silk that has been taken off the winder. Bottom, left: An automatic reeling machine continuously picks up five cocoons at a time and reels them together. Bottom, right: A traditional Japanese wedding gown and headgear made from pure silk. International Silk Assn.

to 42,000,000 lb. Since then there has been a modest recovery, to 68,000,000 lb. in 1960 and to 75,000,000 lb. in 1968. United States consumption of silk has been steadily falling; in 1969 it

reached the lowest point since the end of World War II, 14,983,000 lb. as against 59,510,000 lb. in 1956. Furthermore, whereas in 1956 about 92 percent of U.S. imported silk came from Japan, in 1969 the share of Japan was only 18 percent. The bulk of imported silk, about \$14,000,000 worth annually in the early 1970's, originated in Italy and Korea.

In the U.S. silk is still used for men's lightweight suits, robes and neckties, lightweight coats and slacks, shirts, nightwear; and, in women's and children's clothing, for suits, skirts,

jackets, dresses, loungewear, blouses, underwear, nightwear, hosiery, gloves, and lace. Silk is also used in napery, draperies, linings, narrow fabrics, and handbags.

Sericulture. Sericulture, or the raising of silkworms, involves the incubation (q.v.) of the tiny eggs of the silkworm moth to the point at which they hatch and become worms. After hatching, the worms are placed under a layer of gauze, on which is spread a layer of finely chopped mulberry leaves. During a period of six weeks the worms eat almost continuously. At the end of this period they are ready to spin their cocoons, and branches of trees or shrubs are placed in their rearing houses. The worms climb these branches and make their cocoons in one continuous thread, taking about eight days for the process. The amount of usable silk in each cocoon is small, and about 2500 silkworms are required to produce a single pound of raw silk.

The initial step in silk manufacture after the complete cocoons have been gathered is to kill the insects inside them. Thus the cocoons are first boiled or treated in ovens, killing the insects by heat. The silk fiber is obtained from the cocoons by a delicate process known as reeling or filature. The cocoons are first heated in boiling water to dissolve the gummy substance which holds the cocoon filament in place. Following this heating the filaments from four to eight cocoons are joined and twisted, and are then combined with a number of other similarly twisted filaments to make a thread which is wound on a reel. When each cocoon is unwound, it is replaced with another cocoon. The resulting thread, called raw silk, consists usually of forty-eight individual silk fibers. The thread is continuous and, unlike the threads spun from other fibers such as cotton and wool (qq.v.), is made up of extremely long fibers. The filaments from the coarse outer portion of the cocoon, which is removed by brushing before reeling, and the inner portion of the cocoon, which remains after reeling the raw silk, are spun to produce the low grade of silk thread known as spun silk.

The next step in the processing of silk is the twisting of one or more threads of the raw silk into a strand sufficiently strong for weaving or knitting. This procedure is called throwing. Four different types of silk thread may thus be produced: organzine, crepe, tram, and thrown singles. Organzine is a thread made by giving the raw-silk thread a preliminary twist in one direction, and then twisting two of these threads together in the opposite direction at the rate of about ten turns per inch. Crepe is similar to or-

ganzine but is twisted to a much greater extent, usually between forty and eighty turns to the inch. Tram is made by twisting in only one direction two or more raw-silk threads, with twenty to thirty turns per inch. Thrown singles are individual raw-silk threads which are twisted in only one direction, the number of turns depending on the quality of thread desired. In general, organzine thread is used for the warp threads of materials, and tram threads for the weft or filling. Crepe thread is employed in the weaving of characteristic crinkly fabrics, and single thread for sheer fabrics.

See also FIBER; TEXTILES.

R.D.

SILK-SCREEN PROCESS. See PRINTING TECHNIQUES: *Silk-Screen Process*.

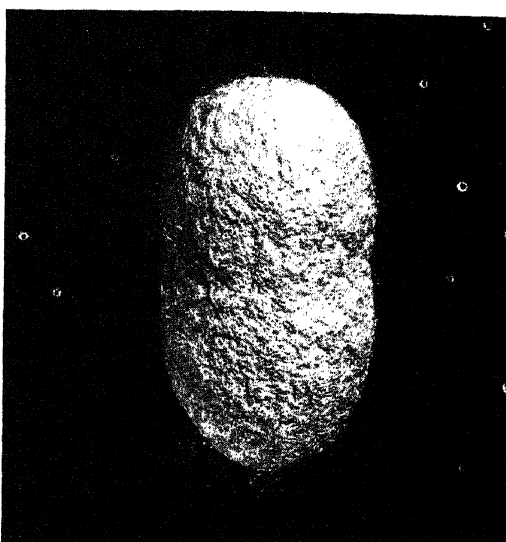
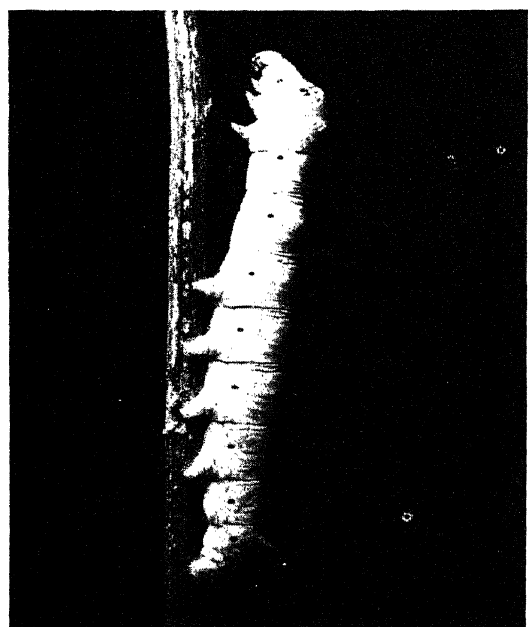
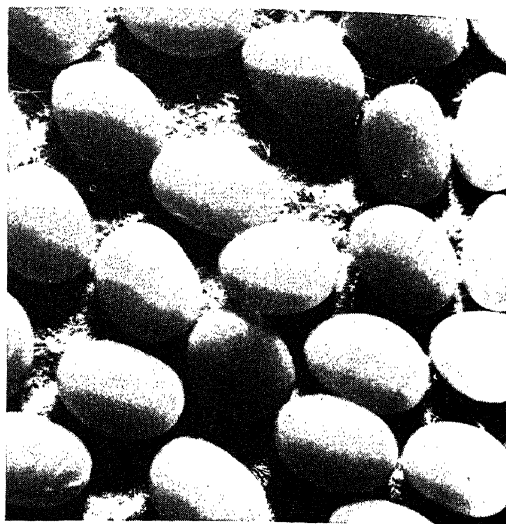
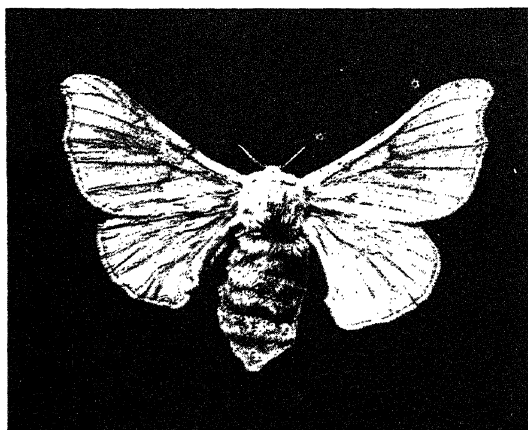
SILKWORM, common name applied to the silk-producing larvae of any of several species of moths. Silkworms possess a pair of especially modified salivary glands called silk glands or sericteries, which are used in the production of cocoons. The silk glands secrete a clear, viscous fluid that is forced through openings, called spinnerets, on the mouthparts of the larva; the fluid hardens as it comes into contact with air. The diameter of the spinneret determines the thickness of the silk thread produced. See SILK.

The best known of the silkworms is the larvae of the common, domesticated silkworm moth, *Bombyx mori*, which belongs to the family Bombycidae. This moth, native to China, was introduced into Europe and western Asia in the 6th century A.D. and into North America in the 18th century. The moth has been cultivated for many centuries and is no longer known in the wild state. Many varieties of the silkworm moth have been produced by breeders, the most important of which produce three broods of young annually.

A typical adult silkworm moth is yellow or yellowish white, with a thick, hairy body, and has a wingspread of about 1½ in. The adult has rudimentary mouthparts and does not eat during the short period of its mature existence; the female dies almost immediately after depositing the eggs, and the male lives only a short while thereafter. The female deposits three to four hundred bluish eggs at a time; the eggs are fastened to a flat surface by a gummy substance secreted by the female. The larvae, which hatch in about ten days, are about ¼ in. long. The larvae feed on leaves of white mulberry, Osage orange, or lettuce. Silkworm caterpillars (see CATERPILLAR) that are fed mulberry leaves produce the finest-quality silk. Mature larvae are about 3 in. long and yellowish gray or dark gray in color.

About six weeks after hatching, the common

SILKWORM



Stages in the development of the silk moth, *Bombyx mori*. Top, left: Adult female. Top, right: Newly laid eggs (much magnified). Bottom, left: Silkworm, or larva. Bottom, right: Cocoon, which contains silk fiber.

U.S. Dept. of Agriculture

silkworm ceases eating and spins its cocoon. The length of the individual fiber composing the cocoon varies from 1000 to 3000 ft. The silkworm pupates for about two weeks; if allowed to complete its pupation period, it emerges as an adult moth. Tearing during emergence damages the silken cocoon beyond commercial use. In the commercial production of silk, only enough adult moths are allowed to emerge to ensure continuation of the species. Most of the silkworms are killed by heat, either by immersion in boiling water or by drying in ovens.

Other moths known as silkworm moths include the giant silkworm moths constituting the family Saturniidae, particularly those of the genus *Antheraea*.

SILLANPÄÄ, Frans Eemil (1888–1964), Finnish writer, born in southwestern Finland, and educated at the University of Helsinki. Sillanpää was the foremost Finnish novelist of the first half of the 20th century. His writings are chiefly impressionistic depictions of the quiet lives of ordinary people. Among his novels are *Life and the Sun* (1916), *The Maid Silja* (1931; Eng. trans., 1933), *Meek Heritage* (1919; Eng. trans., 1938), and *The Beauty and Misery of Human Life* (1945); he also wrote short stories and essays. Sillanpää received the 1939 Nobel Prize in literature.

SILO. See **SILAGE**.

SILONE, Ignazio, original name, **SECONDO TRANQUILLI** (1900-78), Italian writer, born in Pescina, L'Aquila Province, where he was educated. He joined the Italian Socialist Youth Movement in 1917 and later became a member of the Communist Party and editor of several radical political newspapers. He left the Communist Party in 1930 and because of fascist persecution he went into exile the following year. He returned to Italy in 1944 and thereafter remained active in the Socialist Party. Silone's most popular novels, both written while he was in exile, are *Fontamara* (1933; Eng. trans., 1934) and *Pane e Vino* (1937; Eng. trans., *Bread and Wine*, 1936). In these works Silone realistically describes the life of the Italian peasant in the 1930's and totally rejects fascism. His later works include the play *Egli si Nasconde* (1945; Eng. trans., *And He Hid Himself*, 1946), continuing the theme of *Bread and Wine*; and the collected stories and essays, *Uscita di Sicurezza* (1965; Eng. trans., *Emergency Exit*, 1968).

SILURES, people of ancient Britain inhabiting approximately present-day Breconshire, Glamorganshire, and Monmouthshire, Wales. A powerful and warlike tribe, they offered fierce resistance to Roman invaders in 48 A.D. but were finally conquered in 78, after the Romans established a legionary fortress at Isca, modern Caerleon (q.v.). The chief town of the Silures was Romanized as Venta Silurum (modern Caerwent).

SILURIAN PERIOD, division of geologic time in the Paleozoic Era that followed the Ordovician Period and preceded the Devonian Period (qq.v.). The Silurian Period began approximately 440,000,000 years ago and endured for approximately 40,000,000 years.

The transition from the Ordovician to the Silurian Period was marked by the so-called Taconian disturbance, which thrust up a range of mountains on a northeast-southwest line through the region of North America that includes Nova Scotia, New Brunswick, and New England. Later the highlands formed during the Taconian disturbance were eroded, and the resulting detritus was carried away in the form of sand and silt to be deposited over a large area of eastern Pennsylvania and southeastern New York. Volcanoes were active during the Silurian Period in the area comprising Maine, New Brunswick, and Québec.

In the later part of this period, a large, arid basin existed in parts of New York, Ohio, Ontario, and Michigan. A portion of the previously existing inland sea was trapped in the middle of

this basin to form a vast shallow "salt lake" that gradually evaporated, depositing large quantities of salt and gypsum. These deposits are of considerable economic importance in the central New York region.

Rocks of the Silurian system occur in other parts of the world, on all continents and in many countries. Toward the end of the period, mountains were formed in northwestern Europe in the Caledonian disturbance.

Flora and Fauna. The dominant plants during the Silurian Period were seaweeds, and a certain number of land plants also occurred, chiefly primitive, fernlike plants. Among animals, sponges were plentiful and fossils of a large variety of corals have also been found. The most characteristic animals were brachiopods, eurypterids, and crustaceans; see **BRACHIOPODA**; **CRUSTACEA**. Various ganoid fishes were plentiful during the late Silurian Period. The period also saw the emergence of the first air-breathing animals, the scorpions. See **GEOLOGY, HISTORICAL**; **PALEONTOLOGY**.

SILVANUS, in Roman mythology, god of uncultivated fields and forests, the protector of cattle and flocks. Originally a deity without a name who was referred to merely by the adjective *silvanus* (Lat., "living in a wood"), he was later identified with the pastoral gods Pan and Faunus (qq.v.).

SILVER, metallic element with at.no. 47, at.wt. 107.870, b.p. about 2200° C. (3992° F.), m.p. 960.8° C. (1761.44° F.), sp.gr. 10.5^{20°}, and symbol Ag. It has been known and valued as an ornamental and coinage metal since ancient times. Silver mines in Asia Minor were probably worked earlier than 2500 B.C. The alchemists called the metal *Luna* or *Diana* after the goddess of the moon and ascribed to it the symbol of a crescent-shaped moon.

Occurrence. Silver occurs in the pure state to a small extent; the most notable deposits of native silver are in Peru and Norway, where the mines have been worked for centuries. Pure silver is also found associated with pure gold in the form of an alloy known as electrum, and considerable amounts are recovered in the processing of gold. Silver is usually found combined with other elements, of which sulfur is the most predominant, in minerals and ores. Some of the important silver minerals are cerargyrite or horn silver, pyrargyrite, sylvanite, and argentite. Silver also occurs as a constituent of lead, copper, and zinc ores, and half of the world production of silver is obtained as a by-product in the processing of such ores. Practically all the silver produced in Europe is ob-

SILVER

tained from the lead sulfide ore, galena; in the United States relatively few mines are worked for their silver alone, but the silver is mined in conjunction with lead, copper, and zinc. Some of the leading silver-producing districts in the U.S. are Summit Valley, Mont.; West Mountain, Utah; Evolution, Idaho; Coso, Calif.; and Warren, Ariz. In the early 1970's average annual production of silver in the U.S. was about 41,000,000 troy oz., valued at about \$59,000,000. During this period the U.S. maintained about a 14 percent share of the world production of approximately 301,000,000 troy oz.:

Metallurgy. Silver is usually recovered from silver ores by roasting the ore in a furnace to convert the sulfides to sulfates and then chemically precipitating metallic silver. Several metallurgical processes are used to extract silver from ores of other metals. In the amalgamation process liquid mercury, which forms an amalgam with the silver, is added to the crushed ore. After the amalgam is washed out of the ore the mercury is removed by distillation, leaving metallic silver. In lixiviation methods the silver is dissolved in a solution of a salt, usually sodium cyanide, after which metallic silver is precipitated by bringing the solution in contact with metallic zinc or aluminum. For the Parke process, which is used extensively in separating silver from copper and lead ores, see LEAD. The impure silver obtained in the metallurgical processes is usually refined by electrolytic methods (see ELECTROCHEMISTRY) or by cupellation, a process that involves removing impurities by vaporization or absorption.

Properties and Uses. Silver is a white, extremely lustrous metal, capable of taking a high polish. With the exception of gold it is the most malleable and ductile of all metals, and as a conductor of heat and electricity it is superior to all other metals. Its hardness ranges between 2.5 and 2.7; it is harder than gold but softer than copper. Chemically the metal is not very active. It is insoluble in dilute acids and in alkalies but dissolves in concentrated nitric or sulfuric acid. It does not react with oxygen or water at ordinary temperatures. Sulfur and sulfides attack silver, and the tarnishing of silver is caused by the formation of silver sulfide on the surface of the metal. Eggs, which contain a considerable quantity of sulfur as a constituent of protein, tarnish silver very quickly. Small amounts of sulfide, which occurs naturally in the atmosphere and as a component of illuminating gas, tarnish silver at a slower rate.

The use of silver in jewelry, tableware (see SILVERWARE), and as coinage is well known. The

metal is usually alloyed with small amounts of other metals to make it harder and more durable. In the U.S., coin silver was an alloy of 90 percent silver and 10 percent copper until 1965, when the silver content was reduced to 40 percent for half dollars; silver was eliminated from dimes and quarters after 1964. In 1970 the U.S. government sold the last of its marketable silver supply, which in earlier periods of U.S. economic history had been used to support a monetary system of bimetallism; see BIMETALLISM; MONEY. Sterling silver for tableware and other solid-silver objects is 92.5 percent silver and 7.5 percent copper. Silver is used to coat smooth glass surfaces for mirrors (see MIRROR) by vaporization of the metal or by precipitation from a solution. Colloidal silver, dilute solutions of silver nitrate (AgNO_3), and some insoluble compounds, such as potassium, are used in medicine as antiseptics and bactericides. Silver nitrate is also used in the form of cauterizing sticks to destroy infected tissue, and in the liquid form as a treatment for stomach and intestinal diseases, and epilepsy (q.v.). Argyrol, a silver-protein compound, is a local antiseptic for the eyes, ears, nose, and throat.

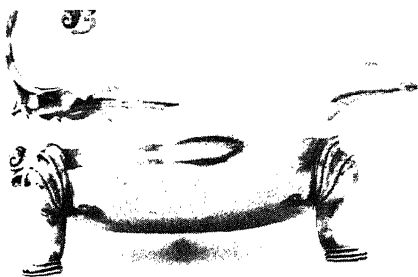
The silver-halide salts, silver bromide, silver chloride, and silver iodide, which darken upon exposure to light, are used in emulsions for photographic plates, film, and paper. The salts are soluble in sodium thiosulfate, which is the compound used in the photographic fixing process; see PHOTOGRAPHY.

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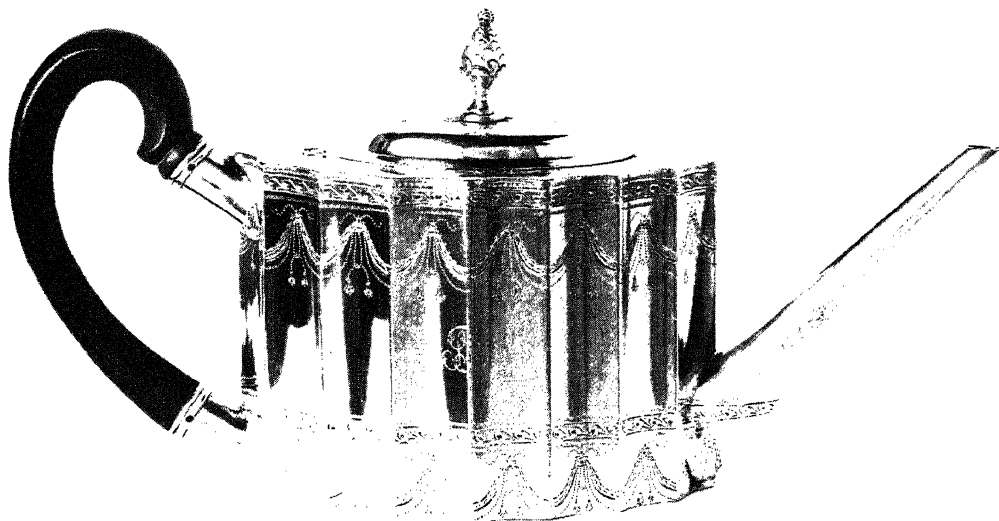
SILVERFISH, common name applied to certain insects of the genera *Lepisma* and *Thermobia*, belonging to the order Thysanura. Silverfish are wingless insects capable of extremely fast movement. Their bodies are covered with silvery scales, are tapered, and terminate in three long, jointed bristles. The silverfish is a common household pest in the United States, feeding on starchy materials like wallpaper, books, or starched clothing. Despite their preference for starchy foods, they have been known also to cause serious damage to rayons. For control of these destructive insects, DDT (q.v.) is effective when sprayed in their usual haunts, as behind bookcases, on closet shelves, around baseboards, and in bathrooms.

SILVER NITRATE. See SILVER: *Properties and Uses*.

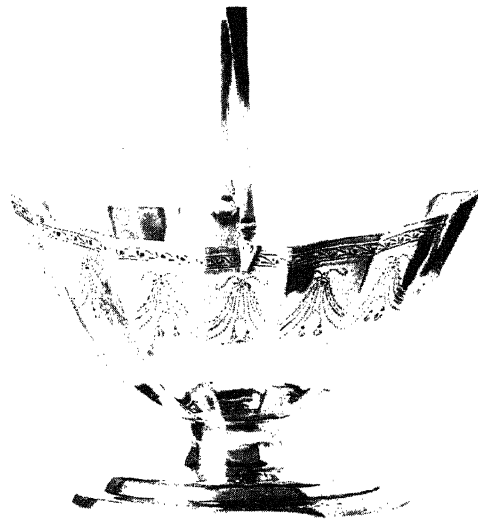
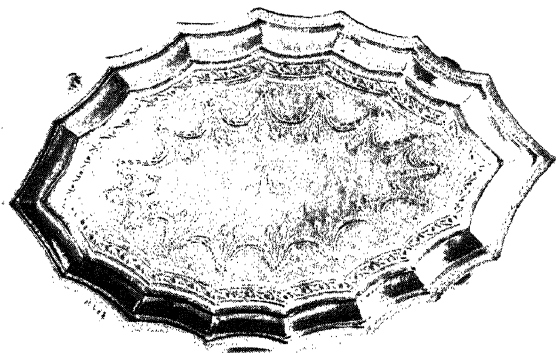
SILVER SPRING, unincorporated community of Maryland in Montgomery County, just N. of Washington, D.C., of which it is a residential suburb. It is the site of Xaverian College, a junior college for men founded in 1931, and of the Applied Physics Laboratory of Johns Hopkins Uni-



Metropolitan Museum of Art – Gift of Mr. and Mrs. Andrew Varick Stott



Metropolitan Museum of Art – Bequest of A. J. Clearwater



Metropolitan Museum of Art – Bequest of A. J. Clearwater

versity (q.v.). Scientific instruments are manufactured in the community. Pop. (1960) 66,348; (1970) 77,496.

SILVERWARE, art objects made out of the metal silver (q.v.), a soft, white, extremely lustrous element, valued for its ornamental uses

Silverware made by Paul Revere. Top to bottom: Pair of sauceboats (about 1765). Teapot (1770–1800). Sugar bowl and stand (1770–1810).

since ancient times. The artisan who makes such articles is called a silversmith. Pure silver is too soft for practical use, and an alloy (q.v.), or

SILVERWARE

mixture of silver with other metals, is used to make the art object harder and more durable. To prevent fraud and to secure a certain standard of purity, hallmarks or plate marks are impressed on articles of silver. The hallmark indicates to the public the true value and fineness of the metal out of which the object is composed. In the United States the standard silver alloy, consisting of 935 parts of pure silver to 65 parts of other metals, is called sterling. The chief centers of the manufacture of silverware in the U.S. are Providence, R.I., Newark, N.Y., and Oneida, N.Y.

Development of the Art. From the time of the early classical periods of Egypt and Greece to the present day, art objects of silver have been created. Perfect examples of silver jewelry (q.v.) and decorative silver objects, some dating from the 1st century B.C., have been found all around the Mediterranean Sea basin (q.v.). Beginning in the 8th century, Carolingian (q.v.) artisans continued in the Roman tradition of artistic metalwork. Most of these articles were for Church use and included small altars, chalices, and reliquaries. In this period, also, silverware became a coveted possession in royal households, with kings and the nobility commissioning silversmiths to provide them with jewelry, plates, cups, bowls, and flatware. As silverworking developed, the design of silver objects followed closely the style of architecture and furniture in a period. At the end of the 18th century the art was influenced by the revival of classic Greek forms. In America the earliest examples are largely imitations of English or Dutch articles, the colonial silversmith Paul Revere (q.v.) being the first name of note in the field.

Silver Plate. An imitation of solid silver produced by using a body of cheaper metal is known commercially as silver plate. The earliest form was Sheffield plate, named from the city in England where the process was developed. Birmingham, also in England, became an important center of the industry. In 1742 the cutler Thomas Bolsover of Sheffield, while repairing a knife, accidentally overheated it, so that the silver melted and spread in a thin coating over the copper. The coating stuck fast when cooled, and thus was invented a method of coating small copper objects with silver by the application of heat. Later the British artisan Joseph Hancock improved the process so that large objects could be produced. Starting with a bar of copper or copper alloy between thin bars of silver, he heated them to fusion and then rolled them and rerolled them into a large flat sheet of silver-plated copper that could easily be shaped

into all kinds of tableware. These were still further embellished by soldering on handles, knobs, and other ornaments of cast or stamped silver. If a cut edge of this plate was exposed, the copper showed, but in 1784 the Sheffield artisan George Cadman overcame this defect by soldering on an ornamental molding of solid silver. The electroplated imitations of Sheffield plate do not have such a molding. Genuine old pieces of Sheffield plate are much prized for the warmth of color and the excellence of the texture, which are far superior to those of electroplated objects. See **ELECTROPLATING**.

See also **METALWORK**.

SIMBIRSK. See **UL'YANOVSK**.

SIMCOE, John Graves (1752–1806), British soldier and diplomat, born in Cotterstock, Northamptonshire, England. He served with the British forces during the American Revolution (q.v.) and in 1777 was given command of the Queen's Rangers with the rank of major. Returning to England in 1781, Simcoe entered Parliament for Saint Mawes in Cornwall. In 1791 he was appointed lieutenant governor of the newly created province of Upper Canada (now Ontario Province). His administration was rendered ineffective by the impracticability of his projects and the friction that developed between him and the governor-general, Sir Guy Carleton (q.v.), 1st Baron Dorchester.

Simcoe was one of the men who in 1794 founded the city of York, later Toronto (q.v.). He left Canada in 1796 and was sent on a military and diplomatic mission to the French colony of Saint-Dominique (see **HISPANIOLA**), which the British had partly occupied. He returned to England the next year. In 1806 he was appointed commander in chief of the British forces in India, but died before he could take up the post. **SIMCOE, LAKE**, lake of s.e. Ontario, Canada, near Toronto. Part of the Trent Canal system, which links Georgian Bay and Lake Ontario, Lake Simcoe is about 50 km (30 mi.) long and covers 743 sq.km (287 sq.mi.). The lake drains into Georgian Bay, to the n.w., via Couchiching Lake and the Severn R. It has several islands, the largest being Georgina Island, and is a popular vacation spot. In a great Indian war of the mid-17th century, the Huron were routed by the Iroquois (qq.v.) in the region of Lake Simcoe.

SIMENON, Georges, principal pen name of **GEORGES SIM** (1903–), Belgian-French novelist, born in Liège. Simenon, a prolific writer, wrote hundreds of popular novels, employing a variety of pen names. He is best known as the author of a series of detective novels about a French police officer, Inspector Maigret, whose

work is marked by unusual psychological insight. These novels achieved outstanding success in Europe and the United States, and editions have appeared in numerous translations throughout the world. Among the many books published in the U.S. are *The Patience of Maigret* (1940) and *Maigret Hesitates* (1970). Simonon's other novels, most of which also deal with crime, include *The Man Who Watched the Trains Go By* (1946) and *Confessional* (1968).

SIMEON STYLITES, Saint (390?–459), Syrian ascetic and pillar saint, born in Sisan (possibly the modern Samandaği, Turkey). He withdrew from a monastery near Antioch (now Antäkyä, Turkey) and in 423 took up residence on a very small platform atop a stone pillar, which fact accounts for his name, Stylites (Gr., "of a pillar"). After leaving this structure, which was about 6 ft. in height, he lived on a succession of pillars, each higher than its predecessor. He made his final home atop a 60-ft. pillar, from which he did not descend during the last thirty years of his life. Pilgrims (see *PILGRIM*) came from many countries to hear him preach. He converted many nonbelievers to Christianity (q.v.) and had numerous disciples, who were themselves called Stylites. Pillar saints occasionally have been found, in the East, even in recent centuries. Simeon's traditional feast day is Jan. 5.

SIMFEROPOL', city of the Soviet Union, in the Ukrainian S.S.R., and capital of the Crimean Oblast, on the Salgir R., about 200 miles s. of Odessa. The city lies in a rich agricultural region and is an important industrial center. Flour milling, canning, and the manufacture of tobacco and leather products are the chief industries. In antiquity the site of Simferopol' was occupied by a Scythian town; see *SCYTHIANS*. A Tatar town known as Ak-mechet, which replaced this settlement, was destroyed by the Russians in 1736. Modern Simferopol' was founded after Russia conquered (1784) the Crimea. Pop. (1970) 250,000.

SIMILE. See *SPEECH, FIGURES OF: Simile*; *POETRY: Poetic Method*.

SIMLA, town in the Republic of India, and capital of Himachal Pradesh Territory, on the s. slopes of the Himalaya, at varying heights between 6500 and 8000 ft., about 170 miles n. of Delhi. It is a summer resort and the headquarters of the Indian army are located here. The Simla Conference, at which representatives of China, Tibet, and Great Britain met to discuss the status and borders of Tibet, was held here in 1913. Pop. (1971 prelim.) 55,326.

SIMONIDES OF CEOS (about 556–about 468 B.C.), Greek lyric poet, born on the island of

Ceos (Kéa). For a time he lived in Athens at the court of the tyrant Hipparchus (d. 514 B.C.), after which he attached himself to the ruling families of Thessaly (see *THESSALIA*), the Scopadae and the Aleuadae. Returning to Athens, he won fame by lauding the heroes and the battles of the Greeks in their struggle with the Persians; see *GREECE: History: Ancient Greece: Hellenic Period*. The latter part of Simonides' life was spent at Syracuse in Sicily, at the court of the Greek tyrant Hiero I (see *under* *HIERO*). He wrote for many patrons in a great variety of poetic forms, including epigrams, elegies, and choral lyric works such as hymns, odes, dirges, and dithyrambs (see *DITHYRAMB*). Little of his work survives. See *GREEK LITERATURE*.

SIMON PETER. See *PETER, SAINT*.

SIMPLON, name applied to an Alpine pass (6590 ft. high), road, and tunnel (2313 ft. high) linking Switzerland and Italy. The road, extending through the pass from Brig to Domodossola (41 mi.), was built (1800–06) by the French. It passes across 611 bridges. The construction of Simplon Tunnel, connecting Brig and Iselle, was begun in 1898 and completed in 1906. A second track, completed in 1922, brought the length to 12.3 mi., making it the longest railroad tunnel in the world.

SIMS, William Sowden (1858–1936), American naval officer, born in Port Hope, Ontario Province, Canada, and educated at the United States Naval Academy. He served on the North Atlantic, Pacific, and China stations; from 1897 to 1900 was naval attaché to the United States embassies at Paris and at Saint Petersburg (now Leningrad); and then served again with the Asian fleet. He served with the bureau of navigation of the Navy Department from 1902 until 1909, and from 1907 to 1909 he was naval aide to President Theodore Roosevelt (q.v.) as well. Sims commanded the U.S.S. *Minnesota* (1909–11), studied at the Naval War College (1911–13), and commanded the Atlantic torpedo flotilla (1913–15). In 1917 he was president of the Naval War College, and the same year became a vice admiral in command of the U.S. naval forces operating in European waters during World War I. In 1918 he was promoted to the rank of admiral, reverting to rear admiral after the war, when he was again appointed president of the War College. Sims, a consistent critic of naval operations, was responsible for major advances in gunnery practices before World War I. In 1920 in an extensive report to a United States Senate subcommittee, he alleged grave errors in the management of operations during World War I. He retired in 1922. He was coauthor with the

SIN

American writer Burton Jesse Hendrick (1870–1949) of *The Victory at Sea* (1920; Pulitzer Prize, 1921).

SIN, lack of conformity to or the transgression of a law believed to have divine sanction. Some doctrine of sin and of reconciling the deity is part of most religions. Zoroastrianism (q.v.) premises a conflict of sin with holiness. The central doctrine of Buddhism (q.v.) turns on the demerit of human actions, which must be purged by transmigration (q.v.). See RELIGION.

In no other sacred book is the sense of sin so fully developed as it is in the Bible (q.v.); see JUDAISM: *Religious Theory and Practice*. Throughout the Scriptures sin appears as the element in man that puts him at enmity with God (q.v.) and requires the work of a Redeemer. In the Christian Church, however, it was not until the controversies between the British monk Pelagius and Saint Augustine (q.v.), the great father and doctor of the Church, at the end of the 4th century, that the doctrine of sin received full development; see PELAGIANISM. The early Greek fathers regarded sin as opposition to the will of God, and as such involving death. But they did not affirm that the guilt of the sin of the first man, Adam (see ADAM AND EVE), or the corruption of his nature descended to all mankind. The early Christian ecclesiastical writer Tertullian (q.v.), in his doctrine of traducianism, held that sinfulness had been propagated from Adam. But it was reserved for Augustine to formulate the doctrine of *peccatum originale* (Lat., “original sin”). He maintained, against Pelagius, that Adam’s sin corrupted man’s whole nature; that his guilt and its penalty pass to all his children; that man is born in a state of sin; and that in virtue of Adam’s original sin, the offspring of Adam is a *massa perditionis* (Lat., “mass of sin”), incapable of satisfying God and naturally disposed to pursue evil only; see EVIL, ORIGIN OF. Pelagius maintained contrary doctrines, and Semi-pelagianism insists that in spite of the weakening of his powers through hereditary sinfulness man is yet not wholly inclined to evil. The Orthodox Church (q.v.) continued to affirm man’s will as being as free as Adam’s before the Fall; see FREE WILL. The Scottish Scholastic John Duns Scotus admitted that man had lost by Adam’s fall *justitia originalis* (Lat., “original righteousness”) but laid stress on the freedom of the will; see DUNS SCOTUS, JOHN; SCHOLASTICISM. The Italian Scholastic and theologian Saint Thomas Aquinas (q.v.) taught that the unbaptized infant is damned; see BAPTISM.

During the Reformation the German and the French reformers Martin Luther and John Calvin

(qq.v.), respectively, asserted what they regarded as Augustinian and Pauline views; see PAUL; THEOLOGY. The Swiss religious reformer Huldreich Zwingli (q.v.) looked on sin as an inherited disease; Arminians (see ARMINIANISM) and Socinians (see SOCINUS) denied hereditary sin altogether. In German philosophical speculation, the Hegelians taught that sin was a necessary condition of the development of mankind; the German theologian and philosopher Friedrich Ernst Daniel Schleiermacher (q.v.), that the sinful state of man was a disturbance of his nature; see HEGEL, GEORG WILHELM FRIEDRICH; PHILOSOPHY: *Modern Philosophy: Hegel and Later-19th-Century Philosophers*. Roman Catholicism (see ROMAN CATHOLIC CHURCH) distinguishes between mortal sin, which destroys man’s relationship with God and merits eternal damnation, and venial sin, which, though serious, does not cut man off from God; see CONFESSION; PENANCE. Protestantism (q.v.) rejects these distinctions.

See also CHRISTIANITY: *Basic Doctrines*.

SINAI, in theological tradition, sacred mountain on which, according to the Old Testament (Exod. 19), the Hebrew prophet and lawgiver Moses received from Jehovah the tables of the Ten Commandments or the Decalogue (qq.v.). In other passages of the Bible, it is sometimes called Horeb. It is a peak in a rocky mass that almost fills the peninsula of Sinai, between the Gulf of Suez and the Gulf of ‘Aqaba. In this mountain mass three separate mountains are clearly distinguishable. Authorities are divided on the identification of the Sinai of Moses. The mountain known as Jebel Katherina has two well-marked peaks, the northern one now called Horeb and the southern, Jebel Musa (Ar., “Mountain of Moses”). It is the latter summit that tradition has selected as the sacred site of the Hebrew lawgiving. Sinai was regarded as a sacred mountain from ancient times (Deut. 33:2, Judg. 5:5) and became an early center of Christian monasticism (q.v.).

SINAI PENINSULA, in physical geography, peninsula of s.w. Asia, at the n. end of the Red Sea. The peninsula lies at the n.e. extremity of Africa, from which it is separated by the Gulf of Suez, an arm of the Red Sea, and by the Suez Canal (q.v.). On the e., the peninsula is bounded by the Arabian Peninsula, from which it is partly separated by the Gulf of ‘Aqaba, another arm of the Red Sea. The n. extremity of the peninsula, which is about 140 mi. long, adjoins the Mediterranean Sea. In political geography, the Sinai Peninsula forms a part of the Arab Republic of Egypt; it was occupied by Israeli troops in 1967.

A level desert occupies most of the n. portion of the peninsula; the s. portion is traversed by several mountain ranges, with summits ranging up to 8550 ft. above sea level. Jebel Musa (Ar., "mountain of Moses"), a summit of the Sinai range, is traditionally identified as the Biblical Sinai (q.v.), the peak on which, according to the Old Testament, Moses (q.v.) received the Ten Commandments from God; see DECALOGUE. Numerous Egyptian inscriptions dating from about 3400 to 1000 B.C. have been found on the peninsula. Near Jebel Musa stands the monastery of Saint Catherine, the autonomous Orthodox religious community in which in 1844 was discovered the *Codex Sinaiticus*, an extant manuscript of the Bible (q.v.) dating from the 4th century.

SINATRA, Frank, in full FRANCIS ALBERT SINATRA (1917–), American popular singer and motion-picture actor. A native of Hoboken, N.J., Sinatra left a job on a local newspaper and soon after, in 1937, took first prize on the radio series called "Major Bowes' Original Amateur Hour". He sang with the bands of Harry James and Tommy Dorsey during the late 1930's, and made recordings of many popular songs. In the 1940's Sinatra became the idol of teenage "bobby-soxers", who swooned over his crooning, soft-voice style of singing. Sinatra began performing in motion pictures in the 1940's in such popular musicals as *Anchors Aweigh* (1945), *Till the Clouds Roll By* (1947), and *On the Town* (1949). For his widely acclaimed performance in the role of Maggio in the film *From Here to Eternity*, he was named the best supporting actor of 1953 by the Academy of Motion Picture Arts and Sciences. Sinatra also gave a number of outstanding performances in such films as *The Manchurian Candidate* (1962) and *The Detective* (1968). In recent years, in addition to frequent motion-picture appearances, Sinatra performed on television and made many recordings. He announced his retirement in 1971.

SINBAD, adventurous hero of the tale *Sinbad the Sailor*, part of the collection of Oriental stories and fables known as Arabian Nights (q.v.). A wealthy merchant of Baghdad, Sinbad makes seven voyages on which he encounters untold dangers and discovers fabulous riches.

SINCLAIR, Upton Beall (1878–1968), American writer and social and economic reformer, born in Baltimore, Md., and educated at the College of the City of New York (now part of the City University of New York) and Columbia University. Sinclair several times was an unsuccessful candidate for political office as a member of the Socialist Party in New Jersey and California be-

tween 1906 and 1930. In 1934 he was the nominee of the Democratic Party for governor of California and campaigned on a platform that promised to "end the poverty in California" through utilizing idle workers and factories to make goods for barter. Although he was never elected to political office, his vigorous criticism of abuses in American economic and social life helped lay the groundwork for a number of reforms. In the 1920's he was one of the founders of the American Civil Liberties Union (q.v.).

The author of ninety books, Sinclair became well known with his novel *The Jungle* (1906), in which his exposition of conditions in the stockyards of Chicago led to an investigation by the Federal government and the subsequent passage of pure food laws. He wrote a number of other critical social and political novels and studies, including works advocating prohibition and criticizing the newspaper industry for suppression and distortion of news stories. His series of eleven novels concerned with the character Lanny Budd, a wealthy American secret agent who participates in important international events, became widely known. The first of these novels was *World's End* (1940); *Dragon's Teeth* (1942), which dealt with Germany under National Socialism (q.v.), won the Pulitzer Prize in 1943; *Return of Lanny Budd*, published in 1953, was the last in the series. His autobiographical works include *Lifetime in Letters* (1959) and *The Autobiography of Upton Sinclair* (1962).

SINE, one of the fundamental trigonometric ratios. In a right-angled triangle, the value of the sine, usually abbreviated sin, of an acute angle is equal to the length of the side of the triangle opposite the angle divided by the length of the hypotenuse. The sine varies in numerical value from 0 to 1 as the angle increases from 0° to 90°. The sine curve is the prototype or idealization of all sinusoidal curves. See TRIGONOMETRY.

SINGAPORE, REPUBLIC OF, island situated off the s. tip of the Malay Peninsula (q.v.) in the South China Sea and constituting a self-governing state in the Commonwealth of Nations. The city of Singapore is at the s.e. end of the island. Between the island and the mainland is Johore Strait, which is about three quarters of a mile wide. The island has no prominent topographical features; only a little more than 12 sq.mi., or roughly 5 percent of the total area, is more than 100 ft. above sea level. The area, including small adjacent islets, is about 224 sq.mi. The mean temperature is about 80° F. and the annual rainfall is about 96 in. The hot, humid conditions sustain luxuriant vegetation, which is now con-

SINGAPORE, REPUBLIC OF

fined to certain areas only; most of the primary jungle and swamps have been reclaimed for industrial and residential purposes. The flora and fauna resemble those of the Malay Peninsula, to which, according to geologists, the island was once joined.

The People. The population (1970 census) was 2,074,507; the United Nations estimated (1971) 2,110,000. The overall population density is 9285 per sq.mi. (1970 U.N. est.). The population consists principally of Chinese (76 percent), Malays (15 percent), Indians (6 percent), and a small number of Europeans. English, Malay, Chinese,

and Tamil are the official languages; English is the language of administration.

The Economy. The city of Singapore (pop. 1969 est., 2,016,800), capital of the republic, is one of the most important ports and commercial centers of Southeast Asia. Among the products of the republic are agricultural products, spices, timber, aquarium fishes, orchids, canned foods, textiles and clothing, rubber, and light industrial goods. In the early 1970's exports were valued at \$2,284,000,000 and imports at \$3,680,000,000 annually. The Singapore dollar, consisting of 100 cents, is the unit of national

*The Singapore River
twists through the heart
of the crowded city. Gov-
ernment and municipal
buildings are grouped
near the mouth of the
river.*

UPI



currency (2.35 Singapore dollars equal U.S.\$1, 1973).

History. The colony was founded as a trading settlement in 1819 by the British colonial administrator Sir Thomas Stamford Raffles (q.v.) and deeded in perpetuity to the British East India Company in 1824 by the sultan of Johore. In 1826 Singapore was incorporated into the colony of the Straits Settlements (q.v.). The advantageous location on the narrow passage between the Indian Ocean and the South China Sea rapidly made Singapore a great port. Great Britain designated it one of its principal naval bases, and extensive defense batteries and forts were constructed on the island. After the Japanese entry into World War II, Singapore became a principal objective of Japan and was captured on Feb. 15, 1942. During their retreat the British destroyed a causeway that linked the island with the peninsula, and sank the Singapore floating dock, the largest in the world. The city was reoccupied by British troops on Sept. 6, 1945. When the colony of the Straits Settlements was dissolved in 1946, Singapore was made a separate crown colony; on June 3, 1959, it became a self-governing state in the Commonwealth of Nations. On Sept. 16, 1963, Singapore, Malaya, North Borneo (renamed Sabah; q.v.), and Sarawak (q.v.) united to form the Federation of Malaysia.

In 1965 Singapore was separated from Malaysia and became a sovereign state, remaining in the Commonwealth and becoming a member of the United Nations. In December of that year the island was proclaimed a republic, with a president and a popularly elected parliament of fifty-eight members. Inche Yusof bin Ishak (1910–70), head of state since 1959, became the first president. He was succeeded in 1971 by Benjamin Henry Sheares (1907–). Executive power is exercised by a prime minister, from 1959 Lee Kuan Yew (1923–), and a cabinet.

In 1969 two free-trade zones were established, which were expected to further strengthen the position of Singapore as a major world trading center. In 1970 the output of factory goods in Singapore, totaling about \$21,000,000, was 20 percent higher than in 1969. The major contributing factors were the growth in domestic exports, a large increase in private investment in new manufacturing enterprises, and a rapid growth in tourism.

In 1971, after 229 years of sole military protection, the British Far East Command withdrew from the island. Singapore subsequently formed a new defense alliance with Australia, Great Britain, Malaysia, and New Zealand.

SINGER, Isaac Bashevis (1904–), American writer, born in Radzymin, Poland, and educated at Tachkemoni Rabbinical Seminary. He contributed to several Yiddish and Hebrew publications in Poland from 1926 until 1935, when he migrated to the United States. He became a naturalized American citizen in 1943. All of Singer's writings in the U.S. first appeared in the *Jewish Daily Forward*, a New York City weekly, with which he became associated in 1935. Writing in Yiddish, he drew heavily upon his own Polish background and the fantasies of Jewish and medieval European folklore; many of his works he translated into English. His novels include *Satan in Goray* (1935; Eng. trans., 1955), *The Family Moskat* (1950; Eng. trans., 1965), *The Slave* (1962), and the two-part work *The Manor* (1967) and *The Estate* (1969). The autobiographical *In My Father's Court* was published in 1966. Singer is perhaps best known for his many collections of short stories that include *A Friend of Kafka* (1970). He won the 1969 National Book Award for children's literature with the publication of *A Day of Pleasure: Stories of a Boy Growing Up in Warsaw* (1969). *A Crown of Feathers and Other Stories*, a collection of previously published short stories, appeared in 1973. See also YIDDISH LITERATURE: *The Postclassical Period*.

SINGER, Isaac Merrit. See SEWING MACHINE: *History*.

SINGING (fr. OE. *singan*, "to sing"; akin to OHG. *singwan*, "to sing"), production and sound of sustained musical tones by the human voice. Six general types of singing voices are commonly recognized: soprano (q.v.), mezzo-soprano, and contralto (q.v.), all three female; and tenor (q.v.), baritone, and bass, all male. Each voice has a normal range of about two octaves. Trained voices, however, sometimes far exceed normal range. Music for sopranos, contraltos, and tenors is written on the treble clef, placing G above middle C on the second line of the staff. Music for the other male voices (and occasionally for tenors) is written on the bass clef, placing the F below middle C on the fourth line. The tenor voice, however, produces tones an octave lower than those written. See also MUSICAL NOTATION; SONG; TONE; VOICE AND SPEECH.

SINGLE TAX, THE, doctrine of social reform developed by the American social philosopher Henry George (q.v.), according to which all taxation would be reduced to a single impost on land. In formulating the doctrine, projected in his book *Progress and Poverty* (1879), George was influenced in part by the ideas of the 17th-century English philosopher John Locke (q.v.) and his contemporaries and successors, and by

SING SING PRISON

the law of rent of the British economist David Ricardo (q.v.); see *ECONOMICS*. George held that all men have an equal right to the use of the land, that land increases in value largely as a result of the growth of the community, and that this value, therefore, is socially created. The prevailing system of land ownership allows landlords to collect most of the socially created value of land and is thereby, in his view, the basic cause of the striking social inequities in modern society. George proposed to retain private ownership and urged that society should appropriate the socially created value of land, leaving to the landowner the full value of the improvements he makes on the land. Virtually the only means necessary to achieve this end, George believed, is the imposition of a tax on land values. Both as a matter of justice and as a stimulus to landlords to improve their land, he proposed that improvements should not be taxed.

Although George upheld capitalism and advocated free trade, his denunciations of social injustices influenced many who called themselves socialists, notably the British playwright George Bernard Shaw (q.v.) and other members of the Fabian Society (q.v.) in England. The influence of George's ideas was also seen in the introduction in the legislatures of California, Oregon, Washington, and Colorado, during the first decades of the 20th century, of proposed constitutional amendments providing for the taxation of land values and for the exemption from taxation of improvements made on the land; these proposals, however, were all defeated. The Graded Tax Laws of Pennsylvania, also reflecting George's theories, permit localities to shift tax incidence from improvements to land. In Australia many communities derive public revenue entirely from a tax on land. At various times the governments of the western provinces of Canada have endeavored to discourage speculation in land by adopting one of George's proposals, the permanent exemption from taxation of improvements on land.

HENRY GEORGE SCHOOL, NEW YORK, NY.

SING SING PRISON. See *OSSINING*.

SINHAILIEN, city of the People's Republic of China, in Kiangsu Province, on the Yellow Sea at the mouth of the Yen R. and its tributary the Shu R., 115 miles s.w. of Tsingtao. The eastern terminus of the Lunghai railroad and a major port, the city exports wheat, corn, flour, beans, bean oil and cake, wine, and salt. The area grows wheat and cotton, and potash deposits are in the vicinity. Fishing and salt-working are carried on along the coast. The city was formed in 1949

when three cities were combined. Of these the farthest inland is Sinhai (Hsin-Hai), known as Haichow until 1912 and then as Jung hai until 1949, the former administrative center that developed with the construction of the railroad in the 1930's. To the n.e. is Sinpu (Hsin-p'u or Sinpuchen), the current administrative center of the city. On the Yellow Sea is the rail terminus and port of Lienyunkang (Lien-yun-gang), which developed in the 1930's as Laoyao and was an independent city called Lienyun from 1935 to 1949. Sinhailien was in Shantung Province from 1949 to 1954. It is also called Hsin-hailien. Pop. (1970 est.) 300,000.

SINHALESE, largest ethnic group of Ceylon (q.v.); also the name of one of the two official languages of the country. The language belongs to the Indic branch of the Indo-European Languages (q.v.). The Sinhalese, who are Buddhists (see *BUDDHISM*), are descendants of colonists from India, who arrived in Ceylon near the end of the 5th century B.C.; they now constitute about seventy percent of the population of Ceylon.

SINISTRALITY. See *LEFT-HANDEDNESS*.

SINKIANG UIGHUR AUTONOMOUS REGION, formerly *CHINESE TURKESTAN*, one of the five autonomous regions of China, in the extreme n.w. of the country, bounded on the n. by the Kazakh S.S.R. of the Soviet Union and the Mongolian People's Republic, on the e. by Ningsia-Hui Autonomous Region and the provinces of Kansu and Chinghai, on the s. by Tibet Autonomous Region, and on the w. by the Republic of India, Afghanistan, and the Kazakh S.S.R. and Kirghiz S.S.R. of the Soviet Union. The capital is Urumchi, or Tihwa (pop., 1970 est., 500,000). Much of the region is surrounded by mountains; in the center the Tien Shan (q.v.) range crosses the region from e. to w. The principal river is the Tarim, the basin of which lies s. of the Tien Shan. South of the Tarim R. is the Taklamakan Desert. To the e. of the desert is the Lop Nor basin, an area of ephemeral marshes and lakes now used as a nuclear test site. Much of the region is desert, and salt basins are numerous; the northern portion, however, is heavily forested. Approximately 10 percent of the entire region is habitable. Farming, with the aid of irrigation, and the raising of yaks, camels, horses, sheep, and cattle are the most important industries. Silk, cotton, hemp, grain, vegetables, and fruits are produced, mostly in the oases that lie s. of the Tien Shan range. There are few manufacturing industries. The chief products include carpets, silk and cotton cloth, and felts. Minerals found in the region include oil in the Tien Shan

range, and coal, saltpeter, alum, sulfur, lead, copper, jade, and gold.

The population of Sinkiang Uighur consists primarily of the Uighur (q.v.), who are Turkish-speaking Muslims. Less than one tenth of the inhabitants are Chinese. Mongols of Buddhist faith also comprise part of the population. Sinkiang Uighur once constituted one of the most important routes between East and West. The silk trade routes passed through it, and the philosophical concepts of Buddhism, the Nestorians, and Islam (qq.v.) reached the Orient by way of the region. Area, 642,252 sq.mi. Pop. (1968 est.) 8,000,000.

SINN FEIN (Ir., "we ourselves"), Irish nationalist society founded by the journalist and political leader Arthur Griffith (q.v.) and his associates about 1902. Its primary aim was to secure



Arthur Griffith

Granger Collection

the political independence of Ireland from Great Britain; the society also sought to make Ireland completely self-sufficient economically, and to promote Irish culture and the use of the Irish language. The formation of Sinn Fein was a direct consequence of the collapse, late in the 19th century, of the Irish Home Rule movement, a collapse caused principally by the split that occurred within the movement after the public disgrace and fall from power of the Irish leader Charles Stewart Parnell (q.v.). The Sinn Fein leaders proclaimed total national independence, rather than mere political autonomy, as their objective. In cooperation with Irish trade unions and socialist groups the Sinn Fein lead-

ers steadily increased their pressure upon the British government.

In September, 1914, shortly after the outbreak of World War I (q.v.), the British Parliament passed a Home Rule Act but delayed its implementation until the conclusion of the war; the independence agitation then began to assume revolutionary proportions. A climax was reached on Easter Monday, April 24, 1916, in the form of an armed insurrection (see **EASTER REBELLION**) organized and carried out by several extremist leaders of Sinn Fein, notably Michael Collins (q.v.). The ruthless suppression of this revolt by the British increased the militancy of the Irish populace. In the elections held shortly after the armistice of November, 1918, seventy-three Sinn Fein delegates were elected to the British Parliament. In January this group constituted itself *Dáil Éireann* (q.v.), or the Assembly of Ireland, proclaimed the independence of Ireland, and named the Sinn Fein leader Eamon de Valera (q.v.) head of the new republic. For the next three years Ireland was the scene of bloody fighting between Irish guerrillas and British military forces. In 1921 the British agreed to open negotiations for the establishment of the southern part of Ireland as the Irish Free State. The resulting treaty was accepted by the majority of Sinn Fein, but a minority led by de Valera rejected it. After an unsuccessful civil war they formed a new party in 1926, *Fianna Fáil* (Ir., "the men of destiny"), as an opposition group. After the establishment of the independent Irish government the importance of Sinn Fein as a political movement diminished rapidly. In the late 1960's and 1970's, however, Sinn Fein members became active in the political and religious struggles in Northern Ireland. See **IRELAND: History**; **IRELAND, REPUBLIC OF: History**.

SINO-JAPANESE WAR. See **CHINA: History**; **JAPAN: History**.

SINON, in Greek mythology, warrior who fought with the Greeks during the Trojan War (q.v.). In the tenth year of the war, when the Greeks had pretended to have departed, Sinon told the Trojans that he had deserted his compatriots because he had been mistreated by Odysseus (see **ULYSSES**). He was thus able to win their confidence and persuade them to take a wooden horse into the city. The horse was filled with armed Greeks. Sinon released the Greeks from the horse at night to capture Troy. See **TROJAN HORSE**.

SINO-TIBETAN LANGUAGES, family of languages spoken throughout a large region extending from northern India in the west to Taiwan in the east, and central Asia in the north to

SINSIANG

the Malay Peninsula in the south. The family is generally divided into two large subfamilies, the Chinese-Thai and the Tibeto-Burman. The Chinese-Thai subfamily is in turn divided into two main branches: the Sinitic, which comprises the language and group of dialects of China, and the Tai or Shan, which is still further subdivided into three groups containing the languages of Lower Burma, the Shan States, and Thailand. The Tibeto-Burman subfamily, though comprising a greater number of individual languages than the Chinese-Thai and spoken by a wider variety of ethnic groups, is more difficult to classify and actually covers a smaller population. Four main branches divided into about nine groups are recognized by most linguists; the provenance of the languages within these groups (of which about thirty have been studied and described by Western linguists) included most of the coastal areas of North and South Vietnam, most of Laos, Tibet and the Himalayan slopes, Assam, Burma, and eastern Bengal.

The entire Sino-Tibetan family is distinguished from the language families of the West by a combination of two main characteristics: isolating (or monosyllabic) character, and the use of tones. The entire family was probably at one time agglutinative, but with the passage of centuries it passed into a monosyllabic stage, though recrudescences and new adoptions of agglutination appear at the present time, particularly in the Tibeto-Burman subfamily. In such a language flexional endings do not occur; each (usually monosyllabic) word is in effect an ideal root, and expresses a discrete idea in sentences whose meanings and syntax are determined entirely by word order and the use of formally independent particles. Parts of speech (such as nouns, verbs, and adjectives) are not differentiated. The disappearance of meaningful affixes from the languages may have led to their other distinguishing peculiarity, the use of variations in tone or pitch to indicate differences of meaning in words which are otherwise pronounced identically. In some extreme cases, such as the dialects of southeastern China, as many as eight distinct tones may be used in voicing what to Western ears seems to be a single word. M.P.

SINSIANG, city of the People's Republic of China, in Honan Province, on the Wai R. and linked with the Hwang Ho (Yellow R.) by the People's Victory Canal, 360 miles s.w. of Peking. A rail junction on the Peking-Hankow line, the city became a river port available to large junks after the construction of the canal in 1953. It is in an area growing grains and beans; industries include flour milling, cotton-textile weaving,

and the manufacture of matches. Sinsiang was created a municipality in 1949. The name is also spelled Hsin-hsiang. Pop. (1970 est.) 300,000.

SINUJU, city in North Korea, and capital of North P'yŏngan Province, at the mouth of the Yalu R., on the Yellow Sea, about 100 miles N.W. of P'yŏngyang. The city became important after a bridge over the Yalu, linking it with Antung, Manchuria, was opened in 1910. It is today a major rail transportation center between North Korea and China. Chief industries include paper milling, alcohol distillation, and soybean processing. Sinuiju was heavily bombed during the Korean War. Pop. (1970 est.) 300,000.

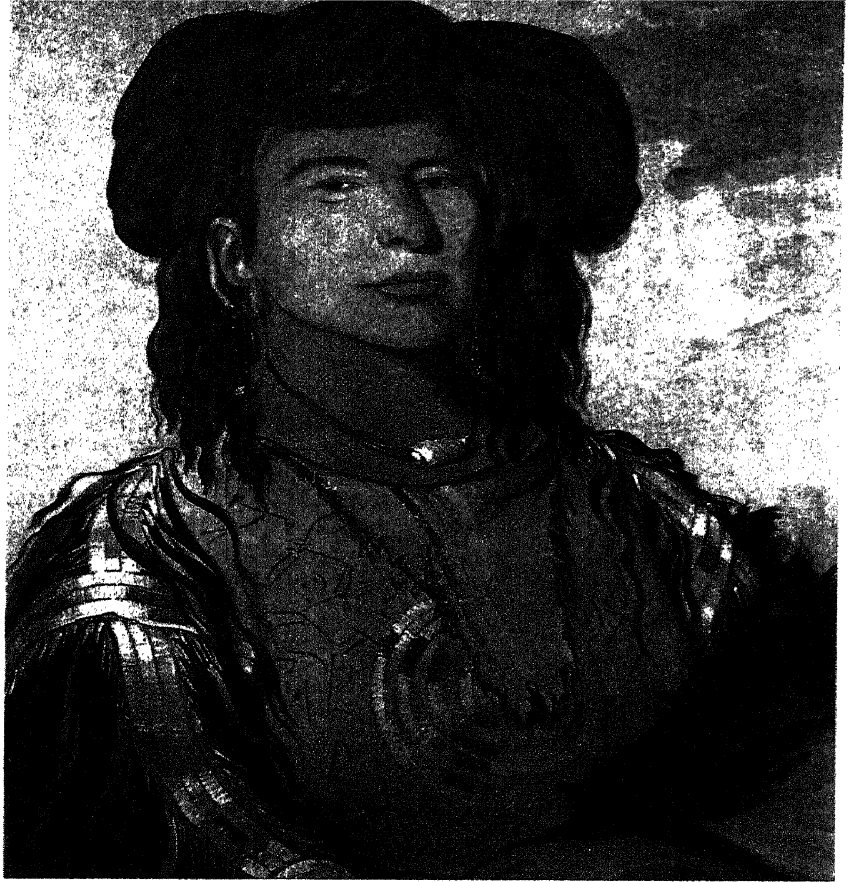
SINUS. See **SKULL**: *Disorders of the Human Skull*.

SIOUAN, family of North American Indian languages, spoken by tribes which dominated the greater portion of the central Plains area (see **PLAINS INDIANS**) until the mid-19th century, and which also held the coast and midland regions of Virginia and the Carolinas and outlying areas on the Gulf coast. These tribes are generally classified according to their languages in the following groups: (1) Sioux, or Dakota, and Assiniboin groups (for minor divisions, see **SIoux**); (2) Dhegiha group, comprising the Omaha, Ponca, Quapaw, Osage, and Kansa tribes; (3) Chiwere group, comprising the Iowa, Oto, and Missouri tribes; (4) Hidatsa and Crow group; (5) Mandan group; (6) Winnebago group; (7) Biloxi group, comprising the Biloxi and Ofo tribes; and (8) Eastern Sioux group, including the Monacan, Catawba, Tutelo, Saponi, Occaneechi, Manahoac, and numerous extinct tribes. The first six of these groups inhabited various parts of the basins of the Missouri and the upper Mississippi rivers; the seventh held the Gulf coast of the State of Mississippi; and the last occupied parts of Virginia and North and South Carolina. The tribes differed greatly in culture. See separate articles on the important tribes among those listed above. See also **AMERICAN INDIANS**: *Indians of the United States and Canada: The Plains Area*.

SIoux, or **DAKOTA**, important confederacy of North American Indian tribes and the dominant group of the Siouan (q.v.) stock. The confederacy formerly inhabited a great expanse of territory embracing northwestern Wisconsin and eastern Minnesota in the region of Lake Superior and the headwaters of the Mississippi R. and extending southwestward through North and South Dakota. Its name is derived from the Ojibwa (q.v.) word *Nadowessi*, literally meaning "little snakes" and metaphorically signifying "enemies"; this designation was corrupted by

"Sioux Chief", a painting by George Catlin, a 19th-century American artist who lived among the Indians and did much to familiarize the American and European public with them. Indians of the plains who resolutely fought to protect their land against the encroachments of the white man, the Sioux today are found on reservations in Montana, the Dakotas, Nebraska, and Minnesota.

Howard Jensen-Scala



French explorers and traders to *Nadowessiou*, which was abbreviated to its present form, and thus passed into English. The Sioux call themselves *Dakota*, *Lakota*, or *Nakota*, according to their various dialects; each of these words means "allies". The tribes are organized in seven principal groups, known as the "Seven Council Fires"; these groups, in turn, fall into three major divisions. The tribal groupings are the Mdewakanton, Wahpekute, Wahpeton, and Sisseton, composed of eastern tribes and constituting the Santee or Dakota division; the Yankton and Yanktonai groups, also composed of eastern tribes, and forming the Nakota division; and the western group, comprising the Teton or Lakota division. The largest division is the Teton, which includes the important Brulé, Blackfoot, Hunkpapa, Miniconjou, Oglala, Sans Arc, and Two-Kettle tribes.

The sedentary and agricultural Sioux of the Santee or eastern division were overshadowed by the Teton or western Sioux, who were nomad warriors and hunters, celebrated for their intelligence, physical strength, and courage. The Teton, constituting about two thirds of the entire confederacy, were Plains Indians

(q.v.) with an economy based on the buffalo.

Contact with Colonial Americans. In the early period of the French occupation of Canada during the 17th century, the tribes of the eastern division had been driven southward from their lands in the region of Lake Superior by the hostile Ojibwa. Apart from this displacement, however, the confederacy retained the same territory from the time it was discovered until its members were placed on reservations by the United States government in the 19th century. The Sioux fought on the side of the British in the American Revolution and the War of 1812 (qq.v.). In 1815 the eastern groups made treaties of friendship with the U.S., and in 1825 the U.S. negotiated a general treaty at Prairie du Chien, Wis., by which the hereditary war between the Sioux and the Ojibwa was ended through adjustment of tribal boundaries, and the Sioux were confirmed in possession of an immense territory extending from the east bank of the Mississippi R. almost to the Rocky Mts. and from near Devils Lake, Wis., to Sioux City, Iowa, including nearly half of Minnesota, two thirds of the Dakotas, and large portions of Wisconsin, Iowa, Missouri, and Wyoming.

SIoux

In 1837, by treaty with the U.S., the Sioux sold all their territory east of the Mississippi R. In 1851 they also sold the greater part of Minnesota, but dissatisfaction occasioned by the delay of the government in fulfilling terms of the treaty of sale led to a series of revolts and massacres of white settlers and soldiers beginning in 1857. A treaty of peace signed in 1868, however, ended this warfare and remained unbroken until the invasion of the Black Hills of South Dakota by gold prospectors and miners provoked another war in 1876. In that conflict the American officer George Armstrong Custer (q.v.) and his entire command of nearly 300 regular troops were wiped out; see *LITTLE BIGHORN, BATTLE OF THE*. The Sioux chief Sitting Bull (q.v.), leader of the irreconcilables, escaped to Canada with several thousand followers, but returned and surrendered in 1881. In 1890–91 a Sioux minority, opposing a new sale of land to the U.S., precipitated another revolt. During the outbreak the Americans killed Sitting Bull to prevent his liberation and massacred about 300 Sioux men, women, and children at Wounded Knee. The revolt was crushed by the American general Nelson Appleton Miles (q.v.). These conflicts brought into national prominence a number of other Sioux chiefs, including Red Cloud (1822–1909), Spotted Tail (1833?–81), Crazy Horse (q.v.), and Gall (1840?–94).

The Indian Policies of the U.S. Government.

Government policy from 1870 to 1920 had a great influence upon later Sioux history. These policies tended to destroy group life by outlawing the sun dance (q.v.), the main Sioux socioreligious institution, and other forms of religious and esthetic expression. The remnants of tribal lands were allotted into individually owned fragments. The Indian Reorganization Act of 1934 slowed the latter trend by allowing these lands to be partially consolidated and by restoring large areas to Indian use. Administrative policies in effect during the 1950's, however, again favored the historical policy of atomizing Indian life, notably in the Great Plains region. In the mid-1950's Sioux-owned lands were passing to white ownership at a rate exceeding one third of a million acres each year. Reacting to these threats to their national existence, the surviving Sioux groups, in conjunction with the National Congress of American Indians, actively sought a restoration of their land base and the institution of a modernized form of traditional Indian life.

The Sioux, who presently number about 40,000, live on various reservations located in North and South Dakota, Minnesota, Montana, and Nebraska. They retain their language, of

which there are three principal dialects, namely Teton, Yankton, and Santee. The language is rich in vowels, euphonious, and strongly nasal. A Sioux-language alphabet, devised about 1850 by Protestant missionaries, provides a basis for an extensive body of writings, including newspaper and magazine journalism, original literary compositions, and accounts of traditional mythology. See also *AMERICAN INDIANS: INDIANS OF THE UNITED STATES AND CANADA*.

SIoux CITY, city and port of entry in Iowa, and county seat of Woodbury Co., on the Missouri R., at the mouths of the Big Sioux and Floyd rivers, 196 miles N.W. of Des Moines. It is served by railroad and a commercial and a municipal airport. The city is the business center for the surrounding agricultural region, including parts of the neighboring States of Nebraska, Minnesota, and South Dakota, maintaining an extensive jobbing, wholesale, and retail trade. It is the sixth-ranking livestock market in the country and an important grain market and meat-packing center. Among the principal industries are the processing of dairy products, the packaging of honey, and the manufacture of machine tools and work clothes.

Sioux City is the site of Briar Cliff College (Catholic), founded in 1930, and Morningside College (Methodist Episcopal), established in 1894. The city has forty-five parks covering an area of 1519 acres. The site of the city was visited in 1804 by the Lewis and Clark Expedition (q.v.). The first settlement on the site was made in 1848. Sioux City was laid out in 1855 and incorporated as a city in 1857. Pop. (1960) 89,159; (1970) 85,925.

SIoux FALLS, city in South Dakota, and county seat of Minnehaha Co., on the Big Sioux R., 58 miles S.E. of Madison. Sioux Falls is the largest city and has the greatest population in South Dakota. It is a wholesale center for the livestock and poultry industries and for goods manufactured in the surrounding areas. Among the industrial establishments in Sioux Falls are extensive stockyards, meat-packing plants, bakeries, and plants processing dairy and other food products. The falls of the river at Sioux Falls furnish abundant water power for the city. Sioux Falls is an episcopal see of the Roman Catholic and Protestant Episcopal churches, and the site of Sioux Falls College (1883) and Augustana College (1860). The Sioux Empire Fair, featuring agricultural, industrial, and horticultural exhibits, is an important annual event. Sioux Falls was settled in 1857 but abandoned in 1862. It was resettled in 1865, when Fort Dakota was founded, and incorporated as a village in 1877

and then as a city in 1883. Pop. (1970) 72,488. **SIPHON**, tube or pipe system consisting of two legs in the form of an inverted U, used to convey a liquid from one vessel at a higher level to another at a lower level, over an intermediate point which is higher than either. When both legs of the siphon are full, the hydrostatic force (see **HYDROMECHANICS**) due to gravity (q.v.) is larger on the longer leg, thus causing the liquid to move toward the lower vessel, even though it may have to move up in the shorter leg. A siphon can be started by filling it with liquid before placing it into its operating location or by applying suction at the lower end after the tube is in position. Once started, the flow will continue until the liquid level in both vessels is equal, or until the level in the higher vessel falls below the inlet of the tube when air is sucked in and the siphoning action stops.

Siphon apparatuses range in size from the simple glass, metal, or rubber instruments used in chemistry laboratories to aqueduct piping systems, which function on essentially the same principle to transmit liquids over an elevation or hill. Large siphoning units, such as are used in municipal water supply systems, frequently have an air removal valve at the top. This valve eliminates the continued presence of air at the highest point, which would block the liquid flow. For a water siphon operating between two vessels open to the atmosphere, the intermediate rise must remain below 33 ft.; at that height, the pressure at the top would become so low that the water would flash into vapor and block the motion. Inverted siphons are occasionally used to carry water across a valley. They are also used on plumbing fixtures to provide a water lock against sewer odors.

See also **HYDRAULIC RAM**.

SIPPAR. See **BABYLONIA**: *History*.

SIQUEIROS, David Alfaro (1896–1974), Mexican painter, born in Chihuahua, and trained at the Escuela Nacional de Belles Artes in Mexico City. He took part in the revival of fresco painting effected by government sponsorship of mural decorations in public buildings and ultimately became one of the best-known Mexican painters, generally ranked with Diego Rivera and José Clemente Orozco (qq.v.). He later executed frescoes in the United States.

A member of the Communist Party and a political activist as well as artist, Siqueiros concentrated in his exterior frescoes on dynamic revolutionary themes to inspire the lower classes. His bold and vividly colored paintings, often representing contorted and intensely emotional figures, became well known through-



"Ethnography" (1939) by David Alfaro Siqueiros.

Museum of Modern Art – Mrs. John D. Rockefeller, Jr., Fund

out the Western Hemisphere. In 1962 the Mexican government sentenced Siqueiros to eight years in prison for organizing left-wing student riots in 1960; the artist was pardoned in 1964. His most monumental work, "March of Humanity", was created on a hotel in the Parque de Lama, Mexico City, after his release from prison.

SIREN, member of tailed, eellike amphibians of the family Sirenidae, comprised of two genera and three species. The 30-in. great siren, *Siren lacertina*, is found along the Atlantic coastal plain, from the District of Columbia south to Florida and Alabama. The dwarf siren, *S. intermedia*, is found from Texas east to southern Louisiana and north to Illinois; it measures about 10 in. The mud siren, *Pseudobranchius striatus*, of Georgia and Florida, seldom exceeds a length of 8 in. All species have only anterior legs present.

SIRENIA, order of aquatic herbivorous mammals, including the dugong and the manatees; see **MANATEE**. These animals attain a length of from 8 to 13 ft. and superficially resemble the walrus (q.v.). The dugong has a bilobed tail fin, whereas that of the manatees is broad and rounded. The dugong inhabits the Red Sea, the Indian Ocean, and the coastal waters north of

SIRENS

Australia. Manatees are found in the warm waters of the Atlantic Ocean off the American and African coasts.

SIRENS, in Greek mythology, sea nymphs, with the bodies of birds and the heads of women, the daughters of the sea-god Phorcys. The Sirens had voices of such sweetness that mariners who heard their songs were lured onto the rocks on which the nymphs sang. The Greek hero Odysseus (see **ULYSSES**) was able to pass their island with safety because, following the advice of the sorceress Circe (q.v.), he stopped the ears of his companions with wax and had himself firmly bound to the mast of the ship that he might hear the songs without danger. In another legend the Argonauts (q.v.) escaped the Sirens because Orpheus (q.v.), who was on board the *Argo*, sang so sweetly that he drowned out the song of the nymphs. According to latter legends, the Sirens, in vexation at the escape of Odysseus or at the victory of Orpheus, threw themselves into the sea and perished.

SIRIUS (Gr. *Seirios*, "scorching"), or **DOG STAR**, brightest star in the sky, situated in the constellation Canis Major (q.v.). The star was highly venerated by the ancient Egyptians, who regarded it as a token of the rising of the Nile and of a subsequent good harvest. Many Egyptian temples were so constructed that the light of Sirius reached the inner chambers. The hottest part of the summer, which coincides with the heliacal rising of Sirius, acquired the name **dog days**.

The brilliance of Sirius in large part is a consequence of its relative nearness to the earth. The distance of the star from the earth is 8.7 light-years or 51 trillion mi., and it is therefore one of the closest stars. It can be seen from every part of the earth. The mass of the star is 2.4 times that of the sun, and its surface temperature is higher than that of the sun. Irregularities in the motion of Sirius led the German astronomer Friedrich Wilhelm Bessel (q.v.) to believe that the star was accompanied by a hitherto unseen companion star. The companion was detected for the first time eighteen years later in 1862 by the American astronomer Alvan Clark (1804–87); it was later shown to be a white dwarf star.

SIROCCO, hot, dry, dust-laden southerly winds, originating in the Sahara (q.v.) desert and blowing off the north African coast during the spring and early summer. While passing over the Mediterranean Sea, these winds pick up moisture and when they arrive on the north shore, blowing chiefly across Italy, Sicily, and

Malta, they are moist, producing humid, oppressive, and rainy conditions. See **WIND**.

SISAL. See **AGAVE**; **HEMP**.

SISAVANG VONG. See **LAOS**: *History*.

SISLER, George Harold (1893–1973), American professional baseball player, born in Manchester, Ohio, and educated at the University of Michigan. Sisler started his professional baseball career in 1915 as a pitcher, left-handed, with the Saint Louis (Mo.) Browns of the American League, but the same year was converted into a first baseman. He subsequently became noted for the phenomenal speed of his fielding and for his batting. He played with the Browns from 1915 to 1927; from 1924 through 1926 he was manager of the team as well. Later he played with the Boston (Mass.) Braves of the National League and the Washington (D.C.) Senators of the American League. Sisler had a career batting average of .340, and he won the batting championship of the American League in 1920 and 1922. He was elected to the Baseball Hall of Fame in 1939; see **BASEBALL HALL OF FAME AND MUSEUM, NATIONAL**.

SISLEY, Alfred (1840–99), French painter of British parentage, born in Paris. His teachers included the French painter Jean Baptiste Camille Corot (q.v.). Sisley, with the French painters Claude Monet and Pierre Auguste Renoir (qq.v.) became one of the leading impressionists (see **IMPRESSIONISM**). Sisley's work attracted little attention during his lifetime but has since been recognized as of distinct importance in the development of impressionism. His paintings include "Flood at Port-Marly" (1876, Louvre Museum, Paris) and "Street in Moret" (1888, Art Institute, Chicago).

SISTERHOODS, in the Roman Catholic Church, Orthodox Church, Church of England (qq.v.), and other Anglican churches, religious societies for women, dedicated to religious and charitable works. The establishment of nunneries, or convents, communities of women withdrawn from the world to practice the religious life, began at about the same time as the growth of similar communities for men.

See also **ABBESS**; **MONASTICISM**; **NUN**; **ORDERS, RELIGIOUS**.

SISTERS OF CHARITY. See **SETON**, **BLESSED ELIZABETH BAYLEY**; **VINCENT DE PAUL, SAINT**.

SISTINE CHAPEL, private chapel of the pope, situated in the Vatican in Rome. It was built between 1473 and 1481 by the Florentine architect Giovanni di Dolci (d. 1486) for Pope Sixtus IV (see *under* **SIXTUS**), after whom the chapel is named. It measures 133 ft. in length, 45 ft. in width, and more than 45 ft. in height; and is

lighted by six windows set high on each side wall and three windows in the rear wall. A marble screen in the Early Renaissance style divides the floor space into a larger area reserved for the pope and the cardinals, and a smaller area for the congregation. The floor is decorated with simple mosaic patterns inspired by Early Christian examples. Walls and ceiling are covered with frescoes that constitute the principal attraction of the chapel and have made it world famous. The walls are decorated with mural paintings by the most notable Tuscan and Umbrian painters of the late 15th and 16th centuries, including Sandro Botticelli, Luca Signorelli, Il Perugino, and Pinturicchio (qq.v.). These art-scenes and others executed two series, each of six scenes, comprising the "History of Moses" on the left-hand wall and the corresponding "Life of Christ" on the right-hand wall. On the ceiling are famous frescoes by Michelangelo (q.v.), commissioned by Pope Julius II (q.v.) and painted between 1508 and 1512. These include scenes depicting Old Testament accounts of the "Creation of the World" and numerous figures depicting Biblical prophets, ancestors of Christ, Greco-Roman sibyls, and male nudes. The wall behind the altar is completely covered by Michelangelo's "Last Judgment", begun in 1534, a single composition, which is one of the largest frescoes in the world. The Sistine Chapel is reserved for papal ceremonies and is also used for the funeral services of a deceased pope and for the election of a new pope. *See also* VATICAN, PALACE OF THE.

SISYPHUS, in Greek mythology, king of Corinth, the son of Aeolus (q.v.), King of Thessaly. Sisyphus saw the god Zeus carry off the beautiful maiden Aegina (qq.v.), and told her father what he had witnessed. Enraged with Sisyphus, Zeus condemned him to Tartarus (q.v.), where he was compelled for eternity to roll to the top of a steep hill a stone that always rolled down.

SITKA, city in Alaska, in the Southeastern Senatorial District, on the w. coast of Baranof Island in the Alexander Archipelago, in Sitka Sound, 100 miles s.w. of Juneau. It is a center for fishing, lumbering, and wood-pulp milling. A fire in 1966 destroyed Sitka's best-known monument, the Russian Orthodox Cathedral of Saint Michael, built in 1844. Adjoining the city is the Sitka National Historical Park, which commemorates the site of the last Indian stand against the Russians in 1804; *see* NATIONAL PARK SERVICE. The city was founded as a fort in 1799 by the Russian fur trader Aleksandr Andreevich Baranov (1746–1819). In 1802 the fort was attacked and the settlers were killed by the Sitka, a tribe

of the Tlingit (q.v.) Indians. Baranov recaptured the fort in 1804 and founded a settlement, which he named Sitka, and which soon became the chief town and trade center of Russian America. The ceremonial transfer of the Alaska Territory from Russia to the United States took place in Sitka on Oct. 18, 1867. Sitka was the capital of the territory until 1900; *see* ALASKA: *History*. It was incorporated as a city in 1920. Pop. (1960) 3237; (1970) 3370.

SITTING BULL, Indian name TATANKA YOTANKA (1834?–90), American Indian leader of Sioux (q.v.), born in the region of the Grand R. in present-day South Dakota. Under the leadership of Sitting Bull, the Sioux resisted efforts of the United States government to annex their lands and force them to settle on reservations. Between June 25 and June 26, 1876, a punitive expedition commanded by the Lieutenant Colonel George Armstrong Custer (q.v.) was annihilated by the Sioux, with the aid of other tribes, in the Battle of the Little Bighorn; *see* LITTLE BIGHORN, BATTLE OF THE. Sitting Bull then fled to Canada. Receiving a promise of amnesty in 1881, he returned to U.S. territory and settled on a reservation. He continued to be hostile to the settlers. The tense situation among the Sioux was aggravated by followers of the Indian messiah Wovoka (q.v.), who promised the defeat of the white man. Because he was considered the leading instigator of the impending rebellion, Sitting Bull was arrested on Dec. 15, 1890. He was shot and killed by his captors when friends tried to rescue him. *See* INDIAN WARS.

SITTWE, formerly AKYAB, city of Burma, and capital of Akyab Division, on the E. coast of Akyab Island, on the Kaladan R., about 230 miles s.w. of Mandalay. Once a fishing village, Sittwe is now an important seaport. The island was of strategic importance during World War II. Captured by the Japanese in 1942, it was retaken by British troops in 1945 and used as a base for the reconquest of Burma. Pop. (1970 est.) 82,313.

SITWELL, name of two brothers and a sister who were prominent British writers.

Dame Edith Sitwell (1887–1964), daughter of Sir George Reresby Sitwell, 4th Baronet Sitwell (1860–1943), born in Scarborough, England, and educated privately. She and her brothers, all nonconformists, were probably the most famous literary family of their time. By her writing and her eccentric behavior and dress, Edith Sitwell both shocked and amused people. A poet, critic, and biographer, she was most successful as a writer of satirical verse or burlesque, as in her well-known *Façade* (1922), recited to music by the British composer Sir William Turner Wal-



Dame Edith Sitwell

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ton (q.v.). Her poetry is notable for its avoidance of outmoded metaphor and imagery; its technical dexterity, especially in the use of dance rhythms; and its ability to communicate sensation and emotion. In 1954 she was made a Dame Commander of the Order of the British Empire. Among her volumes of poetry are *The Mother and Other Poems* (1915), *Gold Coast Customs* (1929), and *Music and Ceremonies* (1963). Her other books include the biographies *Alexander Pope* (1930), *The English Eccentrics* (1933), and *Fanfare for Elizabeth* (1946); a critical work, *Aspects of Modern Poetry* (1934); and an autobiography, *Taken Care of* (posthumously published, 1965).

Sir Osbert Sitwell, 5th Baronet Sitwell (1892–1969), born in London, and educated at Eton College. He was a captain in the Grenadier Guards during World War I. A writer of poems, essays, novels, and short stories, he had a rich and intricate style. He is best known for five books of family memoirs published between 1944 and 1950 under the overall title of *Left Hand, Right Hand*. Although much of his writing is characterized by biting satire, these memoirs paint a nostalgic portrait of the Edwardian age, named after Edward VII (q.v.), King of Great Britain and Ireland. Other works by him include

Tales My Father Taught Me (1962) and *Pound Wise* (1963), a collection of essays.

Sacheverell Sitwell, 6th Baronet Sitwell (1897–), born in Scarborough, England, and educated at Eton College. With profound scholarship, but avoiding a scholarly style, Sacheverell has written highly imaginative and entertaining biographies, travel books, and art criticism, including *Southern Baroque Art* (1924), *The Gothick North* (1929), *Golden Wall and Mirador* (1961), and *Southern Baroque Revisited* (1968). He has also written poetry.

SIVA (Skr., “blessed one”), one of the gods of the Hindu Trimurti (q.v.), or triad of supreme gods. Siva, also called Shiva, personifies both the destructive and the procreative forces of the universe. As the destroyer he is represented wearing a necklace of skulls and surrounded by demons. His reproductive aspect is symbolized by the lingam, a phallic emblem. Siva is also the god of asceticism and of art, especially dancing. He rides on the bull Nandi, and his consort is the mother goddess, called Uma or Kali (q.v.). Some Hindus worship Siva as the supreme deity and consider him a benevolent god of salvation as well as a god of destruction. See HINDUISM; INDIAN MYTHOLOGY.

SIVAS, city in Turkey, and capital of Sivas Province, on the Kizilirmak R., 220 miles E. of Ankara. A trade center and industrial city, Sivas has railway repair shops and manufactures of rugs, bricks, and cement. Built on the site of ancient Sebaste, or Sebastia, the city flourished under the Romans, the Byzantines, and the Seljuks (q.v.). In 1919 Sivas was the site of a nationalist congress held by the Turkish leader Kemal Atatürk (q.v.). Pop. (1970) 132,527.

SIX-DAY WAR. See ISRAEL: *History: The Six-Day War*.

SIX, LES (Fr. “the Six”), group of six French composers who joined together about 1917 under the name *Les Nouveaux Jeunes* for the purpose of presenting concerts of their own music. They later adopted the name *les Six* after a critical article had compared their work with that of the Russian group of composers known as the Mighty Five.

The French group was composed of Arthur Honegger, Darius Milhaud, Georges Auric, Francis Poulenc (qq.v.), Louis Edmond Durey (1888–), and Germaine Tailleferre (1892–1925). These composers, who did not represent any particular school of music, were drawn together by two other Frenchmen, the composer Erik Satie and the writer Jean Cocteau (qq.v.). Favoring jazz and the style of the music hall, *les Six* strongly opposed the music of the French com-

posers who immediately preceded them, especially the excessive romanticism of César Franck, the formalism of Vincent d'Indy, and the impressionism of Claude Achille Debussy and Maurice Ravel (qq.v.). The group, influential in its early years, began to decline in 1926. See FRENCH MUSIC.

SIX NATIONS. See IROQUOIS.

SIXTUS or **XYSTUS**, name of five popes.

Saint Sixtus I (d. 125), pope from 116(?) to 125(?), born in Rome. He took the name Sixtus because he became the sixth successor in the papacy to Saint Peter (q.v.). Among his few recorded achievements is an ordinance regarding the celebration of the Mass (q.v.). His traditional feast day is April 6.

Saint Sixtus II (d. 258), pope in 257–58. He reconciled the churches in Asia Minor (now part of Turkey) and Africa with the church in Rome on the problem of rebaptism of heretics who returned to the orthodox faith. He was martyred in Rome during the persecutions of Christians by the Emperor Valerian (q.v.). His feast day is Aug. 5.

Saint Sixtus III (d. 440), pope from 432 to 440, born in Rome. He was prominent among the Roman clergy before he became pope and was well acquainted with Saint Augustine (q.v.). He abandoned, in the reign of Pope Zosimus (q.v.), an earlier sympathy for Pelagianism (q.v.). Sixtus was responsible for the construction of a number of Rome's finest religious buildings. His traditional feast day is March 28.

Sixtus IV (d. 1484), original name FRANCESCO DELLA ROVERE, pope from 1471 to 1484, born in Celle Ligure, near Savona, Italy. He became a Franciscan friar (see FRANCISCANS) at an early age. In 1464 he was elected general of the Franciscans, and three years later he was created cardinal. During his pontificate the Sistine Chapel (q.v.) in the Vatican (see VATICAN, PALACE OF THE) and the Sistine Bridge across the Tiber R. were constructed, and the Sistine choir was founded. He involved the papacy in war (1478–80) with Florence and supported (1480–84) the Venetian war against Ferrara. Sixtus, who was a patron of arts and letters, has been censured for promoting unworthy relatives to high ecclesiastical offices and for pursuing secular matters to the neglect of spiritual ones. He tried unsuccessfully to moderate some of the excesses of the Spanish Inquisition, although he had originally consented to its establishment in 1478; see INQUISITION. Sixtus impoverished the papal treasury, and his reign is usually thought an unsuccessful one. **Sixtus V** (1520–90), original name FELICE PERETTI, pope from 1585 to 1590, born near Mon-

talto, Italy. Of humble parentage, he joined the Franciscans (q.v.) at 12 and was ordained in 1547 after study at a number of universities. The following year he was awarded a doctorate in theology by the University of Fermo. Peretti was created bishop of Sant' Agata dei Goti in 1566 and of Fermo in 1571. Meanwhile, in 1570, he was made a cardinal; at this time he adopted the surname Montalto. Inactive for almost fifteen years, he was unanimously elected pope, succeeding Gregory XIII (see under GREGORY), as the compromise choice of two papal factions. His pontificate was marked by immense expenditures on public works in Rome, including construction of the Lateran Palace (see LATERAN). In 1586 he set the number of cardinals at seventy. He established fifteen sacred congregations (departments) in 1588 to administer the spiritual and secular affairs of the Holy See; see ROMAN CATHOLIC CHURCH: *Hierarchy*. A powerful administrator who ruled with unremitting severity, he enforced the decree of the Council of Trent (1545–63; see TRENT, COUNCIL OF) against simony and the holding of more than a single benefice, or church office. He also enacted reforms of his own. He gave strong support to overseas missions in the East and in South America. Sixtus found an empty treasury on entering the papacy, but through taxation, loan flotation, and other means was able to replenish it.

SJAE LLAND, or **ZEALAND**, largest and most important island of Denmark. It lies between the Kattegat and the Baltic Sea, and is separated by the Øresund from Sweden and by the Great Belt from the island of Fyn. The coasts, which are rockbound on the s.e., are indented by bays and fiords. Agriculture and cattle breeding are the leading occupations. The chief city is Copenhagen (q.v.), the Danish capital. Area, 2709 sq. mi.; pop. (1970 est.) 2,139,009.

SKAGERRAK, strait between the s. coast of Norway and the Jutland Peninsula of Denmark. Together with the Kattegat Strait, it connects the North Sea with the Baltic Sea. About 150 mi. long and from 75 to 90 mi. wide, the Skagerrak is shallow near Jutland but deepens near the Norwegian coast. The strait is subject to violent storms. During World War I the naval Battle of Jutland was fought in the Skagerrak; see JUTLAND, BATTLE OF.

SKAGWAY, city in Alaska, in the southeastern senatorial district, at the n. end of the Lynn Canal, 75 miles n.w. of Juneau. Skagway was settled in 1897 and was the port through which all supplies and traffic to and from the Canadian Klondike (q.v.) passed during the gold rush of

SKATE

that year. The city is a tourist center. Pop. (1960) 659; (1970) 675.

SKATE, common name applied to the ray (q.v.) constituting the family Rajidae. This flat-bodied elasmobranch is common in most warm and temperate seas, including the coastal waters of the United States. The flesh of the European or gray skate, *Raja batis*, which attains a weight of 100 lb., is extensively eaten in Europe; skate flesh is not a common article of American diet. The smallest and commonest of the skates found along the eastern coast of North America is the little or hedgehog skate, *R. erinacea*, which attains a length of less than 2 ft., and which is densely spotted with black on its upper surface. The winter skate, *R. diaphanes*, closely resembles the hedgehog skate but is somewhat larger and somewhat lighter in color. Another common skate of the American Atlantic coast is the smooth or barndoor skate, *R. laevis*, which attains a length of about 4 ft. The big skate, *R. binoculata*, found off the coast of California, is the largest of the American skates, attaining a length of about 8 ft.; the egg cases deposited by the female are almost 1 ft. long.

SKATING. See ICE-SKATING; ROLLER DERBY.

SKEAT, Walter William (1835–1912), British philologist, born in London, England, and educated at the University of Cambridge. In 1873 he founded the English Dialect Society. From 1878 to 1912 he was professor of Anglo-Saxon at the University of Cambridge. He was a noted authority on Old and Middle English dialects and edited many early English texts; see ENGLISH LANGUAGE: History. His works include an edition of *Piers Plowman* (1867–85) and a seven-volume edition (1894–97) of the works of the English poet Geoffrey Chaucer (q.v.). He also wrote *An Etymological Dictionary of the English Language* (1882).

SKEENA, river of w. British Columbia, Canada, 579 km (360 mi.) long. It rises in the Skeena Mts. and flows s.w., through the Coast Mts., before emptying into Chatham Sound (an arm of the Pacific Ocean), near Prince Rupert. The river is navigable for about 160 km (100 mi.) upstream. Its chief tributaries are the Babine and Bulkley rivers. The upper Skeena is a spawning ground for salmon.

SKEET SHOOTING. See TRAPSHOOTING AND SKEET SHOOTING.

SKELETON, term applied to all the rigid or semirigid structures supporting the soft tissues of the animal body and providing leverage for muscular action. In animals lower than the vertebrates on the zoological scale, the skeleton is known as an exoskeleton and is secreted out-

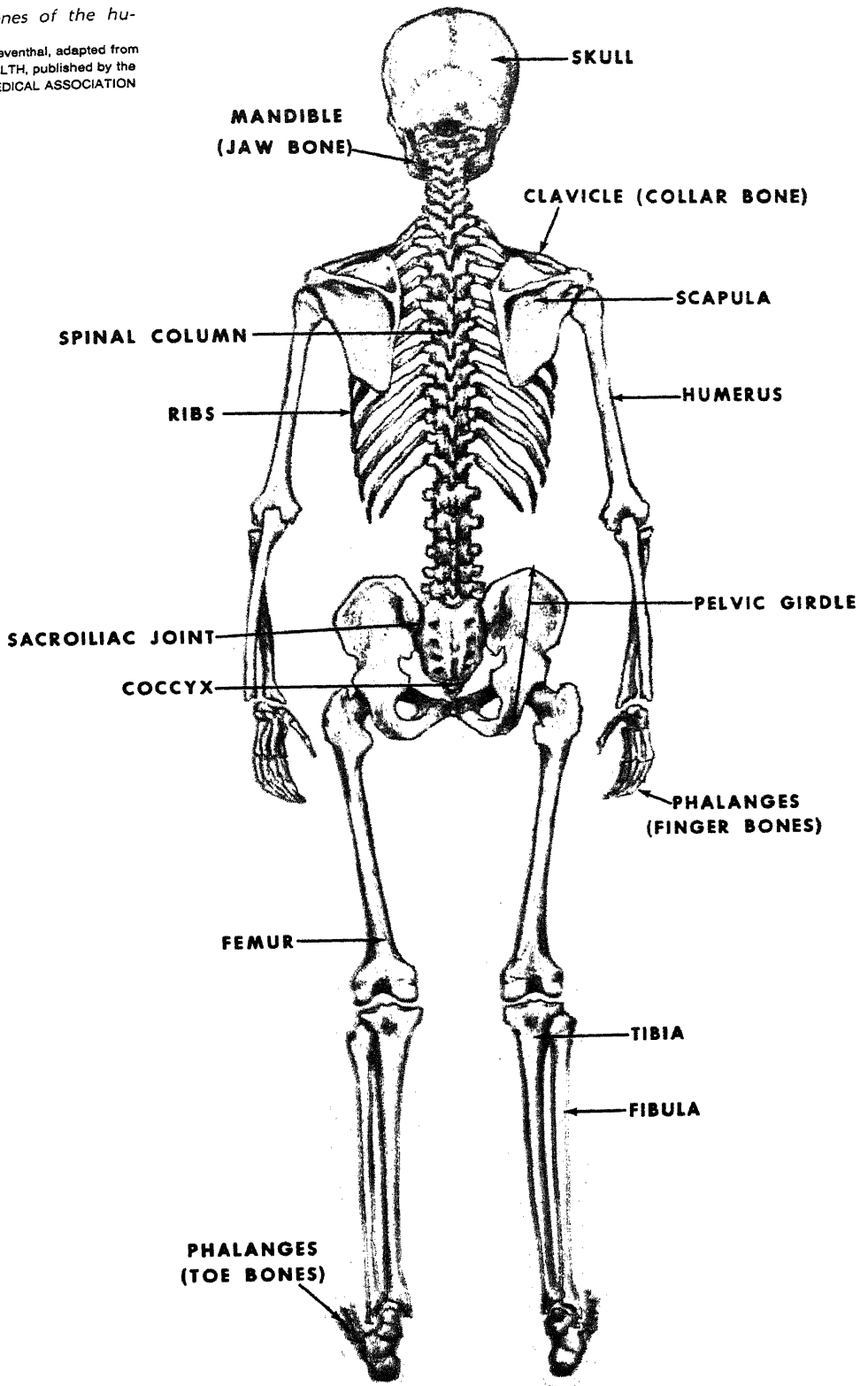
side the soft tissues of the body. In vertebrates, the skeleton, which is known as an endoskeleton, is formed within the body; accessory exoskeletal structures, such as teeth, scales, nails, claws, horns, and hair may also occur, but serve none of the functions of the invertebrate exoskeleton.

Exoskeleton. A form of exoskeleton is the shell of calcium or silica secreted by certain protozoans known as Foraminifera. Commercial sponges have an exoskeleton consisting of spongin, which is a tough, elastic substance; the exoskeletons of other sponges are composed chiefly of hard, slender, pointed bodies of calcareous or silicious matter. Coelenterata secrete a wide variety of exoskeletal substances, ranging from the elastic covering of many Hydrozoa, such as the jellyfish, to the stony material deposited by many Anthozoa such as coral. The familiar shells of most Mollusca are composed of calcium carbonate and an organic ground substance known as conchiolin. Among Echinodermata, bony plates known as ossicles are distributed in the outer layer of the body covering; in some echinoderms, such as the sea urchins, these plates form a shell, but in others, such as the sea cucumbers, they are diffusely distributed over the body. The exoskeletons of Arthropoda resemble the endoskeletons of vertebrates more than the skeletons of any invertebrates, probably because the arthropods are the only invertebrates that possess jointed limbs or appendages. Each of the three principal divisions of the body of an arthropod, the head, the thorax, and the abdomen, is enclosed in a framework of horny plates; the plates of each primary division are separated from those of the next division by elastic tissue that permits flexibility of motion. The appendages are enclosed by sheaths projecting from the exoskeleton; elastic tissue similar to that between the exoskeletal plates joins the segments of the appendages and attaches them to the body. In addition to the exoskeleton proper, many arthropods possess apodemes, or internal projections from the exoskeleton; these serve as points of attachment for the muscular system.

Endoskeleton. Vertebrates have a more or less rigid group of structures composed of cartilage or bone or of a combination of these two connective tissues. The most primitive of these structures is the notochord, which is a backbone of cartilage occurring in the lower Chordata, such as the ascidians, and in primitive fishes. In animals higher on the zoological scale, an organized endoskeletal system appears. This system constitutes the axial skeleton, which is

Principal bones of the human body.

Laura Dean Leventhal, adapted from
TODAY'S HEALTH, published by the
AMERICAN MEDICAL ASSOCIATION



SKELTON

made up of the skull, spinal column, and ribs; the appendicular skeleton, which is made up of the pelvic and pectoral girdles (see *COLLARBONE*) and the appendages; and the visceral skeleton, which occurs in fishes as a branched basket supporting the gill arches and which persists in higher animals as the hyoid bone, situated at the base of the tongue, as the ossicles of the ear, and as the cartilage of the larynx.

In lower vertebrates, such as the Cyclostomata and Chondrichthyes, the skeleton is composed of cartilage throughout the life of the organism. In higher animals, the skeleton formed in the embryo is initially cartilaginous; bone and calcium are deposited as the organism matures. In man, the process of ossification is completed at about age twenty-five; the last bone to ossify is the sternum, or breastbone.

The total number of bones in any animal varies with its age; many bones fuse together during the ossification process. The average number of distinct skeletal structures in a young human is two hundred, exclusive of the six ossicles found in the ears. The scientific study of the bones composing the vertebrate skeleton is known as osteology.

The human skeleton is subject to a number of pathological conditions, most important of which are fracture and a deficiency disease known as rickets (q.v.).

See separate articles on most of the species, substances, and structures mentioned.

SKELTON, John (1460?–1529), English poet and satirist, born probably in Diss, Norfolk, and educated at the University of Cambridge. He was a tutor to Prince Henry, later Henry VIII (q.v.), King of England, and received royal patronage. Skelton was ordained a priest in 1498 and became rector of Diss about 1502. He is best known for his satirical poems attacking the court and the corruption of the clergy. Skelton's verse is written in a unique style known as Skeltonics, which is characterized by short, alliterative lines with a persistent repetition of the same rhyme. His poems include *The Bowge of Court* (1499) and *Why Come Ye Not to Court?* (about 1522).

SKEPTICISM (Gr. *skeptikos*, "thoughtful", "reflective"), in philosophy, doctrine that the knowledge of substantive reality, or reality as it is in itself apart from human perception, is impossible. The term also denotes an individual's state of mind prior to his formulation of conclusive opinions; that is, at a time when he is in the process of questioning his beliefs. Skepticism is the antithesis of dogmatism (see *ДОГМА*), or the positive statement of opinion as though it were

an established fact. By gradual extension of its meaning, skepticism has come to signify doubt about what is accepted generally as true. The most common objects of doubt in skeptical systems of philosophy are the existence of an absolute reality transcending human experience (metaphysical skepticism) and the possibility of correct and valid knowledge (epistemological skepticism). Inasmuch, however, as doubt respecting metaphysical or supersensible reality depends, in the final analysis, upon suspicion of man's ability to know anything about such reality, all skepticism is ultimately epistemological; that is, it is based upon views as to the scope and validity of human knowledge.

Greek Skepticism. The Greek Sophists (q.v.) of the 5th century B.C. were for the most part skeptics. Their rationale is epitomized in the statements "Man is the measure of all things" and "Nothing is; or if anything is, it cannot be known". Thus the Sophist Gorgias (d. about 380 B.C.) declared that all statements concerning reality are false and that, even if true, one could never prove their truth. Another Greek Sophist philosopher, Protagoras (q.v.) of Abdera, taught that man can know only his perceptions of things, not things themselves.

The principles of skepticism were first given systematic formulation by the Pyrrhonists, a school of Greek philosophy (q.v.) deriving its name from its founder, Pyrrho (q.v.) of Elis. Pyrrho maintained that man can know nothing of the nature of things, and that consequently it is the part of wisdom to suspend judgment. Timon of Philius (fl. about 280 B.C.), Pyrrho's pupil, carried skepticism to its logical conclusion by asserting that equally good reasons can be adduced both for and against a philosophical proposition. With respect to skepticism itself, this assertion implies that equally valid reasons can be given for an antiskeptical as for a skeptical view. The members of the so-called Middle Academy, which was intermediate between the Old Academy of Plato (q.v.) and the New Academy of Carneades (q.v.) and Clitomachus (fl. about 129 B.C.), were somewhat less radical in their skepticism than the Pyrrhonists, since they entertained some doubt as to the value of a skepticism that doubted everything. Carneades maintained that no beliefs can be proved conclusively but that some can be shown to be more probable than others. Aenesidemus (fl. 1st cent. B.C.) set forth in his *Ten Tropes* ten arguments in support of the skeptical position. Another noted skeptic of antiquity was the Greek physician Sextus Empiricus (fl. early 3rd cent. A.D.), whose writings are an important source of

information about other schools of philosophy as well as skepticism.

The Middle Ages. The Scottish scholastic philosopher John Duns Scotus (see DUNS SCOTUS) made use of skeptical arguments to demonstrate the fallibility of human reason and the necessity for dependence upon divine revelation as the only means of obtaining true knowledge; see SCHOLASTICISM. During the Renaissance (q.v.) the influence of ancient skepticism exhibited itself preeminently in the writings of the French philosophical essayist Michel de Montaigne (q.v.). The great exponent of modern skepticism was the 18th-century Scottish empiricist philosopher David Hume (q.v.); see EMPIRICISM. In his *Treatise of Human Nature* (1739) and *Enquiry Concerning Human Understanding* (1748), Hume questions the possibility of demonstrating the truth of beliefs about the external world, causal connections, future events, or metaphysical entities such as the soul and God. Skepticism with regard to ultimate knowledge finds expression in the works of the German philosopher Immanuel Kant and the British philosopher Herbert Spencer (qq.v.). Both deny the ability of the human mind to know things as they are in themselves, and posit the unknowability of the absolute. The American philosopher George Santayana (q.v.) pushed Hume's skeptical view of knowledge to its furthest extreme in his work *Scepticism and Animal Faith* (1923), maintaining that belief in the existence of anything, including oneself, rests on an irrational impulse. In theology (q.v.) the term "skepticism" is used to designate the attitude of doubt toward the fun-

damental postulates of religion, such as the existence of God, free will (q.v.), and the immortality of the soul.

See also EPISTEMOLOGY; METAPHYSICS; PHILOSOPHY; RATIONALISM.

R.A.

SKIING, technique and sport of traversing snow-covered terrain with the feet mounted on skis, long, narrow runners of wood or metal. The skis distribute the skier's weight over an area much greater than that covered by his feet, thus enabling him to glide swiftly over the snow instead of sinking into it. Skiing is a competitive sport, a form of recreation, and a means of travel in snowy, upland regions, notably for military units engaged in or training for mountain warfare. As a sport and form of recreation, it is popular in the Scandinavian countries, Great Britain, France, Switzerland, Germany, Austria, Czechoslovakia, Yugoslavia, Italy, Japan, the Soviet Union, Canada, and the United States. The governing body of American skiing is the United States Ski Association (formerly the National Ski Association); the Fédération Internationale de Ski controls world skiing.

Equipment. The chief items of equipment needed for skiing are two skis, two poles, and a pair of specially designed boots. One of the most rigorous of winter sports, skiing also usually requires that the participant wear warm but lightweight clothing including elastic or stretchable pants, parkas or other jackets, woolen face masks, protective goggles, and snow-proof gloves.

A competitor exhibits winning form in executing a jump in a ski-jumping meet.

Dan Young - Manité



SKIING

Skis average from 6 to 7 ft. in length and are made usually of metal, fiber glass, or laminated woods, notably hickory, ash, oak, or spruce. Short skis are also available for beginners and children. The front, or toe, end of the ski curves slightly upward and narrows at its extreme limit to a point. The width of a ski ranges from about $2\frac{3}{4}$ in. at the place where the foot rests to about $3\frac{3}{4}$ in. toward the front of the ski; at the point where the upward bend of the ski begins, its thickness is from $1\frac{1}{4}$ in. to $\frac{3}{4}$ in. Attached to each ski is a special safety binding, a device that firmly attaches the boot at the toe and the heel to the ski. Bindings are made of leather and metal and are designed to free the foot from the ski in the event of a fall, thereby preventing serious injury.

The ski poles, used for support and balance, are metal or wooden staffs, from 4 to 5 ft. long. One pole is gripped in each hand and secured there by means of a leather loop, or strap. The lower ends of the poles are pointed. Near the pointed end of a ski pole is a small disk made out of metal and leather or plastic. Known as the snow ring, it provides resistance when the skier digs the pole into the snow.

Ski boots are square-toed shoes of reinforced heavy leather usually extending just above the ankle. The tip and heel of a ski boot are grooved to fit into the binding on the ski. All-plastic boots have recently been developed and are gaining favor.

Types of Competition. The most widely publicized form of skiing is the competitive sport, which tests most of the skills required for effective recreational, military, or utility skiing. The basic events of skiing competition are the jumping contests and cross-country races, which are linked as Nordic events; and the downhill, slalom, and giant slalom, which are known as Alpine events. Participants in all but the jumping contests use the poles to maneuver and maintain balance.

In executing a jump, the competitor crouches and glides down a steep, snow-covered slide, usually constructed on a hillside; at the bottom of the slide he leaps from a platform, called the takeoff, with the objective of attaining a maximum distance before landing. The event is judged by the distance covered and the form exhibited by the contestant. Jumping from longer slides on higher takeoffs is known as ski flying.

The downhill event is a contest of speed in which the participants race in a generally straight line down a slope containing a variety of natural and artificial barriers. The fastest

elapsed time from top to bottom of the slope is the criterion of victory. Downhill racers must be especially adept at vaulting across obstacles with the aid of their poles, meanwhile maintaining balance and speed.

The slalom is a downhill speed race in which contestants follow a zigzag course marked by a series of flags; the event tests the ability of the contestant to turn sharply at high speeds. The giant slalom is a longer, steeper course with flags farther apart.

In cross-country races, contestants travel over a course, usually 15 or 30 km (about $9\frac{1}{2}$ or 19 mi.) long, which contains uphill, downhill, and level ground in approximately equal proportions. Level and gradually ascending terrain is crossed with long, sliding strides accompanied by vigorous thrusts of the ski poles. Steeper grades are climbed usually by means of a herringbone movement, so called because of the pattern of marks it leaves in the snow.

Ski Patrol. The National Ski Patrol System, a nationwide nonprofit organization of competent skiers who are skilled in rescue and first aid on the slopes, provides standby aid to skiers at ski centers across the U.S. The patrolmen, as well as those of local ski patrols, are intensively trained and wear identifiable jackets bearing Red Cross emblems; see RED CROSS, THE AMERICAN NATIONAL. Most members of the National Ski Patrol System are volunteers; in 1970-71 there were some 25,000 volunteer patrolmen in the national system.

History. Skiing has been a means of transportation in snowy regions for many thousands of years. The Djurgården Museum, in Stockholm, Sweden, has on exhibit a pair of skis reputedly more than 5000 years old. The literature of the ancient world contains accounts of skiing, notably among the Lapps (see LAPLAND). During the Middle Ages (q.v.) ski troops were used extensively in warfare in the Scandinavian countries. Skiing came into general use in central Europe in the late 16th century and attained popularity subsequently in many parts of the world. The first known ski club was organized in Norway in 1870.

Skiing was introduced into the U.S. in the first half of the 19th century by settlers from Scandinavian countries and probably also by Indians from Canada; skiing clubs were subsequently founded in the U.S. In January, 1886, the first American ski tournament was held in Red Wing, Minn. The National Ski Association (today the U.S. Ski Association) was founded in 1904 in Ishpeming, Mich., and the Fédération Internationale de Ski was created in 1924. In the latter year



Skiing. Plate 1. The slopes at Sun Valley, Idaho, offer challenge and excitement to skiing enthusiasts.

George Schwartz - FPG



Skiing. Plate 2. The Winter Olympic Games provide matchless examples of championship skiing form. Above: Gregory Swor represents the U.S. in the competition at Sapporo, Japan, in 1972. Below: Jean-Claude Killy of France heads toward a gold medal in the downhill ski event at Grenoble, France, in 1968. His victories in the men's slalom and giant slalom gave him the triple crown of Alpine skiing in that year.

UPI



the first Winter Olympics (q.v.), including skiing contests, were held in Chamonix, France.

The sport received major impetus in the U.S. due to the Winter Olympic competitions, particularly those held at Lake Placid, N.Y., in 1932, and from the construction of palatial ski centers in the New England States, Colorado, Idaho, Utah, California, Oregon, Washington, and in various Canadian provinces. Many ski resorts in the U.S. and abroad were equipped with ski tows and aerial tramways, or lifts, which eliminated the necessity of climbing mountainsides on foot between ski runs or jumps. An increasing number of ski centers now also make use of snow-making machines to cover, maintain, and improve slopes with artificial snow when nature fails.

See also WATER-SKIING.

SIKIDA, formerly PHILIPPEVILLE, city and port of Algeria, in Constantine Department, on the Gulf of Stora, about 38 miles N.E. of the city of Constantine. Exports include fruits, vegetables, livestock, wheat, iron, and marble. Major industries include the processing of fish and agricultural products, the smelting of iron ore, and the manufacture of aluminum. The site of the city has been occupied by successive settlements since remote antiquity. The present city was founded by the French in 1838. Pop. (latest est.) 85,000.

SKIMMER or **SCISSORBILL**, any of various gull-like waterbirds of the Skimmer family, Rynchopidae, and noted for their rapid skimming, in flight, along the surface of water. As much as 19 in. long, the skimmer is found along the coasts and rivers of Africa, eastern North America, and southern Asia. The bird has sensitive eyes with slitlike, vertical pupils and, although it is inoffensive, it has a raucous cry. Skimmers roost on beaches during the day and do their skimming at night. In skimming, the uniquely longer lower part of the bladelike bill is kept below the surface to scoop in insects, shrimp, and small fish. The body is kept at an angle to keep the wings from touching the water. Three species exist, that in America being the American black skimmer, *Rynchops nigra*, which is black above with a white underside; the bill is scarlet and black and the legs are scarlet. Although the black skimmer is found chiefly in the eastern United States, it is also seen as far south as Argentina.

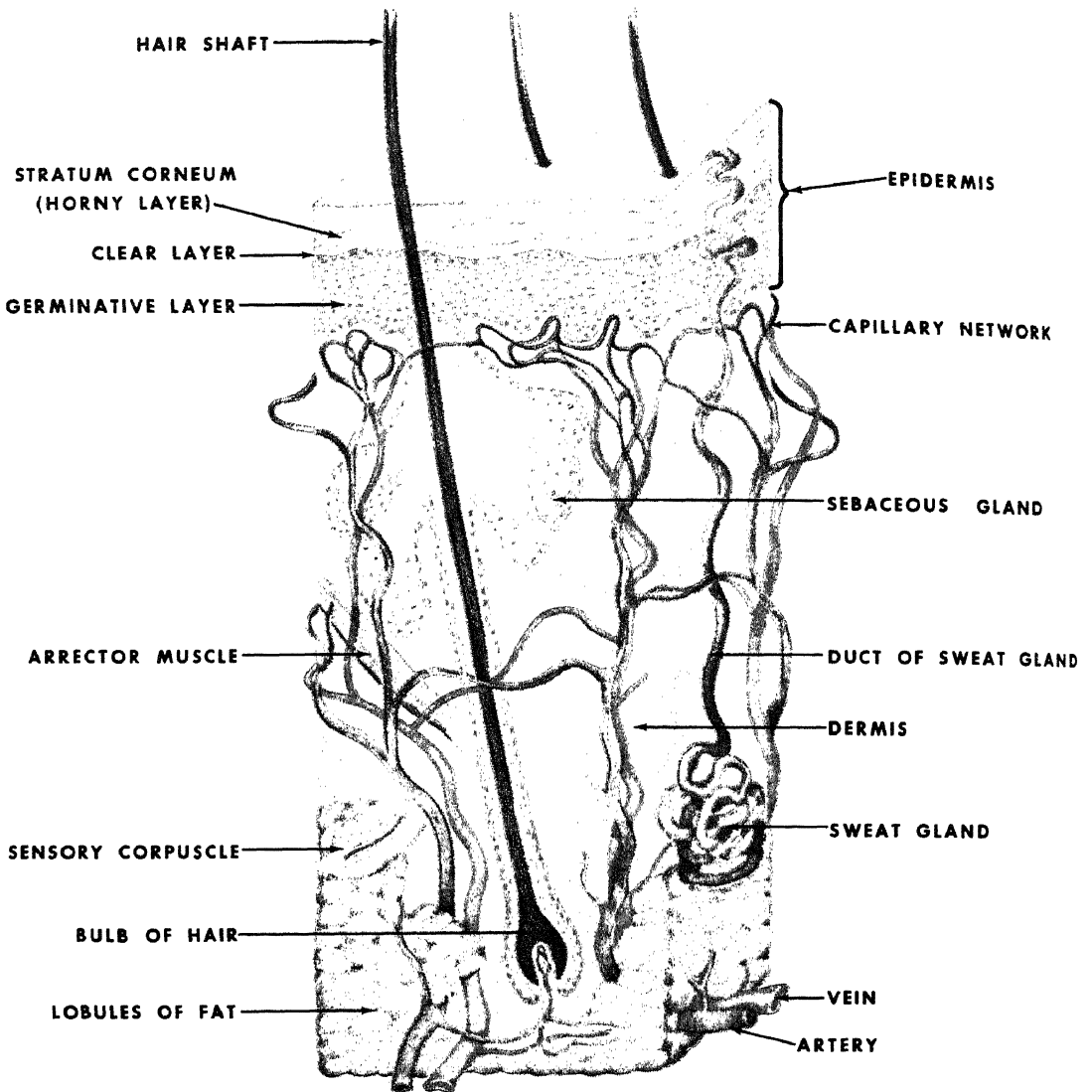
SKIN, in anatomy, protective organ covering the external surface of the body and merging, without break, at the various body openings, with the mucous membranes of the alimentary and other canals. The skin forms a protective

barrier against the action of physical, chemical, and bacterial agents on the deeper tissues and contains the special end organs for the various sensations commonly grouped as the sense of touch. Through the activity of its sweat glands and blood vessels, it is important in maintaining body temperature. One square inch of skin contains up to fifteen feet of blood vessels which have as one of their functions the regulation of body temperature.

When the body temperature rises, radiant energy, or heat, is lost due to vascular dilatation and increased blood flow to the skin surface. When the temperature is low, blood vessels constrict to reduce blood flow and subsequent heat loss through the skin. Each square inch of skin also contains hundreds of sweat glands which are controlled by a heat regulation center in the brain. These glands secrete moisture which evaporates, cools the body surface, and helps maintain normal body temperature. In this capacity the skin acts as an excretory organ. The skin is elastic, and except for a few areas such as the palms, soles, and ears, is loosely attached to the underlying tissues. The color of the skin varies normally with the amount of pigment (q.v.) deposited in the skin cells as governed by heredity, exposure to sunlight, or difference of race; see RACES OF MANKIND. The color also varies in disease because of difference in pigment, as in Addison's disease (q.v.), or because of pigmented substances carried to it by the blood as in jaundice (q.v.). In certain places the outer layers of the skin are modified to produce the hair and nails (qq.v.). The skin varies in thickness from 0.02 in. (0.5 mm) on the eyelids to 0.17 in. (4 mm) or more on the palms and soles.

In structure the skin is composed of two distinct layers. The outer layer, called the epidermis or cuticle, is several cells thick and has an external, horny layer of dead cells which are constantly shed from the surface and replaced from below by a basal layer of cells, the stratum germinativum. The inner layer, called the corium or dermis, is composed of a network of collagen and elastic fibers, blood vessels, nerves, fat lobules, and the bases of hair follicles and sweat glands. The interface between the epidermis and dermis is extremely irregular and consists of a succession of papillae, or fingerlike projections which are smallest where the skin is thin and longest in the skin of the palms and soles. The papillae of the palms and soles are associated with elevations of the epidermis which produce ridges that are the basis for fingerprint identification; see FINGERPRINTING. Each papilla contains either a capillary loop of blood vessels

SKIN



Magnified cross section of the skin.

Laura Dean Leventhal, adapted from TODAY'S HEALTH,
published by the AMERICAN MEDICAL ASSOCIATION

or a specialized nerve ending. The vascular loops, supplying nutrients to the epidermis, outnumber the neural papillae by about four to one.

Sweat, or sudoriferous, glands are found on every part of the body. They are numerous on the palms and soles but relatively sparse on the skin of the back. Each gland consists of coiled tubules which are situated in the subcutaneous tissue and a duct that extends through the dermis and forms a convoluted spiral through the epidermis. Sebaceous glands, saclike glands which secrete the sebum that lubricates and

softens the skin, open into the hair follicles a short distance below the surface of the epidermis.

Skin Diseases. The skin is prone to diseases from external as well as internal causes. Inflammation of the skin, or dermatitis (q.v.), may often result from exposure to physically or chemically irritating substances in industry, from contact with such vegetable poisons as the toxin of poison ivy, or from sunburn, overexposure to the ultraviolet rays of the sun. Infection of the skin with pyogenic streptococci gives rise to impetigo and erysipelas (qq.v.) and infections of the skin spread throughout the body, as in syphilis, smallpox and tuberculosis (qq.v.), and general systemic disorders may produce skin

symptoms, as in measles, scarlet fever and chicken pox (qq.v.). Foreign proteins, or proteins to which the body is unduly sensitive, may affect the skin by producing hives (q.v.), or wheals, whether the protein reaches the skin through the blood stream or whether it is applied directly to the skin. Patients are often tested by placing a small amount of the protein on a small scratch in the skin; sensitivity is indicated by the appearance of a wheal; see ALLERGY. Eczema (q.v.), formerly considered to be the commonest of skin diseases, is now regarded as a symptom of any of a variety of conditions, including external local irritations, disorders of the blood, and allergy. Other skin affections include tumors, sebaceous cysts (wens), ulcers and pigmentations which are congenital (see NEVUS), or are caused by disorders of the internal secretions (see HORMONES), or melanoma (see Cancer). See also ACNE; IVY POISONING; PSORIASIS; SEBORRHEA; SUMAC. For a discussion of burns and frostbite, see FIRST AID: *Burns: Frostbite*.

Skin Grafting. Destruction of extensive areas of skin is sometimes caused by injury, as in the case of burns, by surgical removal, or by disease, as in large ulcers. Regeneration of the skin over such denuded areas takes place naturally by proliferation of cells from the surrounding margins of healthy skin and the underlying skin appendages. However, the ability of skin to regenerate is limited by the formation of scar tissue, which prevents the regrowth of skin over the denuded area and may cause disability of the part by forming contractures or adhesions. Complete coverage of the damaged area is facilitated by the use of skin grafts, sections of skin of either full thickness or partial thickness depending on the indications, cut from another part of the body and applied to the raw surface, to which they adhere readily. In successful cases, the graft is nourished at first by the serum oozing from the damaged tissue, and later by the proliferation of capillaries from the tissue into the graft. Eventually it merges with the surrounding skin to cover the entire area.

In general, permanent grafts can be made only from skin transplanted from the body of the same individual, called autografts, or from an identical twin. With the exception of transplants from identical twins, skin grafts from one person to another, called allografts, are usually sloughed in about three weeks. According to present-day theory, allografts are temporary because the host recognizes the presence of the foreign tissue and his immune mechanisms produce antibodies that destroy the foreign skin; see IMMUNITY. However, such grafts are useful as

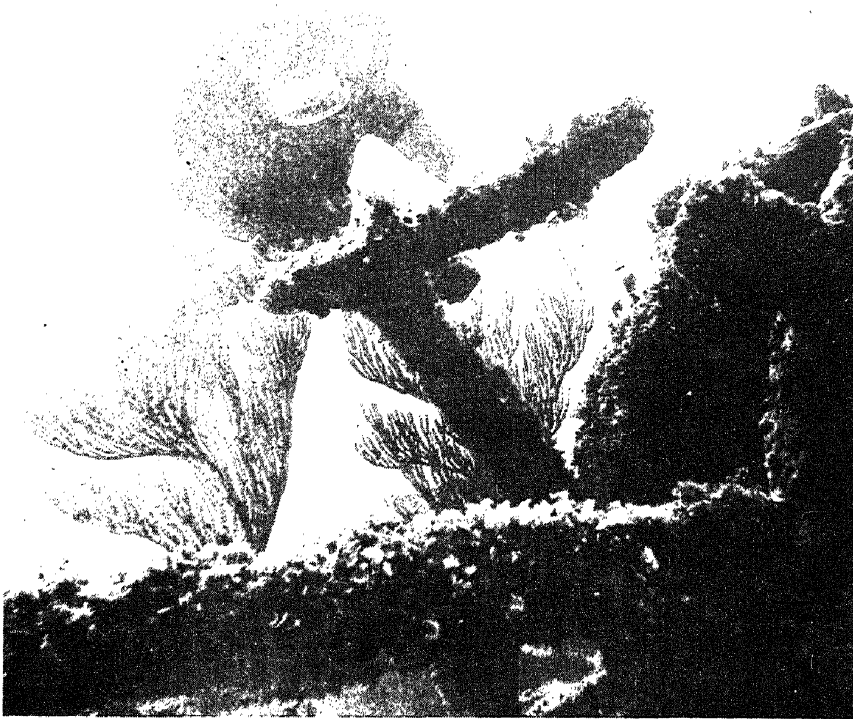
temporary dressings in cases of extensive burns, or other large-area damage, until the patient is well enough to undergo grafts from his own body. The skin of recently deceased persons was used in allografts for the first time in 1955, and in the same year the first skin bank for civilians was established in the United States. See also PLASTIC SURGERY. R.O.N.

SKIN DIVING, aquatic sport and occupation in which swimmers, using a self-contained breathing device, or dependent on lung capacity, remain underwater for periods ranging from one minute to two hours.

Skin-Diving Equipment. Skin diving with the aid of a self-contained breathing device is more properly known as scuba diving. The basic items of equipment in skin diving, of which there are several forms, are a waterproof face mask and rubber fins or flippers worn on the feet. The face mask is designed to fit the contours of the face snugly; having a pane of shatterproof glass, it affords clear underwater vision. The rubber flippers enable the diver to swim underwater almost 50 percent faster than swimmers on the surface. Other optional items of skin-diving equipment include a long sharp knife, a weighted belt, and a depth gauge. The knife is useful under various possible circumstances, notably to free the diver when his lines are entangled. Many divers use weighted belts to control their buoyancy while under water. The depth gauge, worn like a wrist watch, enables divers to check their distance from the surface. In addition, many divers carry spears, made of wood or metal, with which they impale fish for sport (spearfishing) or as a means of self-protection. The spears are thrust at the fish by hand or shot out of devices, called spear guns, powered by rubber slings, metal springs, gunpowder, or compressed gas.

Breathing. When underwater, skin divers depend for their air supply on lung capacity, on breathing devices called snorkels, or on various types of self-contained underwater breathing apparatus (SCUBA). The advantage of lung-power diving is that it enables swimmers to navigate freely, without the encumbrance of special breathing equipment, at depths to and beyond 35 ft. Most lung-power divers can remain submerged for relatively brief periods, usually less than two minutes. Experienced divers, however, have been known to stay beneath the water for almost 10 minutes.

The most elementary form of artificial breathing apparatus is the snorkel, a hollow plastic tube with a mouthpiece at one end and a simple, valved opening at the other. By keeping the



A skin diver wears an underwater breathing device and rubber fins.
Florida State News Bureau

open end above the surface the skin diver can study the underwater scene indefinitely. Snorkels are rarely more than 15 in. in length, as air cannot be drawn from the surface at greater depths. A snorkel-equipped diver may dive freely, however, for as long as he can hold his breath.

Among the best-known self-contained breathing devices is the aqualung, which was invented in 1943 by the French scientists Jacques-Yves Cousteau (q.v.) and Émile Gagnan. The aqualung consists essentially of one or more tanks of compressed air, a system of valve mechanisms, an inhalation hose, an exhalation hose, and a mouthpiece. Swimmers equipped with an aqualung and two tanks of compressed air can remain submerged for more than an hour. The record depth for a diver wearing SCUBA gear and breathing compressed air is 437 ft. A diver breathing mixed gases, notably helium and oxygen, can go as deep as 1000 ft. Authorities warn, however, that amateur skin divers should stay above the 30-ft. mark and should learn the sport only under expert guidance.

Skin diving received considerable impetus from the exploits during World War II of naval underwater demolition experts, known popularly as frogmen. During the postwar era skin

diving became a popular sport in many countries, including the United States. Besides spearfishing, the favorite pastimes of skin divers include exploration of the ocean bottom, underwater photography, and searching for sunken treasure. Commercially skin diving is important in the pearl industry.

See also DIVING; OCEAN AND OCEANOGRAPHY.

SKIN GRAFTING. See PLASTIC SURGERY: *Specialized Techniques*; SKIN: *Skin Grafting*.

SKINNER, American actor and his daughter, an actress and writer.

Otis Skinner (1858–1942), born in Cambridge, Mass. He made his debut in Philadelphia in 1877 and subsequently appeared with many of the prominent actors of his day. He toured with the famous Polish actress Helena Modjeska (q.v.). Skinner had varied repertoire. In addition to his most famous role, Hajj in *Kismet* (1911), by the British playwright Edward Knoblock (1874–1945), he was noted for his acting of Shakespearean roles, especially Hamlet, Falstaff, and Shylock. Skinner also wrote several books, including *Footlights and Spotlights* (1924).

Cornelia Otis Skinner, (1901–), born in Chicago, Ill. She studied acting with the French actor and critic Jacques Copeau (q.v.) and in 1921 made her debut in Chicago with her father's company. She was most noted for her per-

formances of dramatic monologues that she wrote herself. The author, with the American writer Emily Kimbrough (1899–), of *Our Hearts Were Young and Gay* (1942), a volume of travel memoirs, she was coauthor of the play *The Pleasure of His Company*, with American playwright Samuel Taylor (1912–), in which she starred in 1958–60. She wrote two books on the fashionable world of Paris in the 1890's: *Elegant Wits and Grand Horizontals* (1962) and *Madame Sarah* (1967), a biography of the French actress Sarah Bernhardt (q.v.). In addition, she wrote extensively for periodicals, lectured, and appeared on such radio and television shows as *Information Please*.

SKINNER, B(urrhus) F(rederic) (1904–), American psychologist, born in Susquehanna, Pa. He received a Ph.D. degree in 1931 from Harvard University and has been a member of its faculty since 1948. Skinner was the foremost exponent in the United States of the behaviorist school of psychology, which seeks to explain human behavior in terms of physiological responses to external stimuli; see **BEHAVIORISM**. He is also the originator of programmed instruction (q.v.), a teaching technique in which the student is presented a series of ordered, discrete bits of information, each of which he must understand before proceeding to the next stage in the series. A variety of teaching machines (q.v.) has been designed that incorporate the ideas of Skinner. Among his important works are *Behavior of Organisms* (1938), *Walden Two* (1948), *Verbal Behavior* (1957), *The Analysis of Behavior* (with James Gordon Holland, 1961), and *The Technology of Teaching* (1968). In *Beyond Freedom and Dignity* (1971), Skinner advocates mass conditioning as a means of social control.

SKOKIE, village of Illinois, in Cook Co., in the Skokie Valley (a former marsh), on the North Shore Channel, adjoining Chicago on the N. and 7 miles N.W. of the downtown area. Industries include map and book printing and publishing, sawmilling, and the manufacture of electrical and electronic equipment, metal products, textiles, and chemicals. Skokie is the site of the Hebrew Theological College (1922). Incorporated in 1888, the village was known as Niles Center until 1940. Pop. (1960) 59,364; (1970) 68,627.

SKOPJE, or **SKOPLJE** (Turk. *Üsküb*), city in Yugoslavia, and capital of the constituent republic of Macedonia, on the Vardar R., about 200 miles S.E. of Belgrade. The city is a market center for the tobacco, cotton, and grain grown in the surrounding region. Industries include the manufacture of soap, cement, carpets, and pottery and the processing of agricultural products and

opium. Skopje was founded by the ancient Romans and captured by the Serbs in 1282. Conquered by the Turks in 1392, it was an important city of the Ottoman Empire until after the Balkan Wars (q.v.) of 1912–13, when it was ceded to Serbia (q.v.). With Serbia it became part of Yugoslavia in 1918. On July 26, 1963, most of the city, including many ancient mosques, was destroyed by an earthquake. It was quickly rebuilt and its industries reestablished. Pop. (1971) 312,091.

SKUA, gull-like bird of the family Stercorariidae, native to Antarctica, in which the nostrils open beneath the edge of a horny cere and other structural oddities exist; see **GULL**. This bird is rapacious, attacking and annoying terns and small gulls and compelling them to drop fish they have already taken. The skua strikes down living birds as hawks do, and also attacks small penguins. It is about 23 in. long and about 4 ft. in extent of wings, with plumage dusky above and below. Three closely related species, known in the New World as jaegers, are white below; see **JAAGER**.

SKULL, term applied to the rigid cartilaginous or bony structure located anterior to the spinal column in all vertebrate animals, and serving to encase and protect the brain and to provide attachment for the muscles of the face and mouth. In lower vertebrates, such as cyclostomes and elasmobranchs, the skull is composed of cartilage throughout the lifetime of the organism; in teleost fishes and in more highly developed vertebrates including man, the skull is cartilaginous during embryonic and fetal life, becoming ossified early in postnatal life. See **VERTEBRATES**.

The Human Skull. The adult human skull is divided into two regions, namely, the cranial and the facial regions, and the bones composing each region are classified as cranial or facial bones. The cranial region is the portion of the skull directly surrounding the brain; the facial region includes all the other bones of the skull.

Exteriorly, the cranial bones include the two frontal bones, which constitute the forehead and which fuse together in late adult life; the two parietal bones, which constitute the top of the head and which in early childhood are separated from the frontal bones by a space called the anterior fontanel; the single occipital bone, constituting the back of the skull, which is pierced by a large opening through which the spinal cord enters the cranial cavity; and the two temporal bones, which constitute the temples and the sides of the head and which bear the zygomatic processes, or cheekbones. The

SKUNK

human temporal bone represents the fusion of four bones found in lower mammals: the squamosal bone, which constitutes the side of the head and which articulates with the jawbone; the petrosal bone, which contains the inner ear; the mastoid bone, which is situated behind the ear; and the tympanic bone, which surrounds the channel leading from the eardrum to the external ear. Internally, the cranial bones include the ethmoid bone, which forms part of the septum of the nose and through which the olfactory nerves pass from the brain to the upper and middle turbinates; the sphenoid bone, which constitutes most of the floor of the cranial cavity and which houses the pituitary gland (q.v.); and part of the occipital bone. The floor of the cranial cavity contains three terraced depressions, which contain the cerebellum and the frontal and temporal lobes of the cerebrum. See BRAIN.

The facial bones include the two nasal bones, which constitute the upper portion of the bridge of the nose; the two lacrimal bones, which are located in each eye orbit next to the nose and close to the tear ducts; the maxillary bone, which constitutes the upper jaw; the mandible, which constitutes the lower jaw; the two palatine bones of the hard palate; the vomer, which, with a part of the ethmoid bone, constitutes the nasal septum; and the two inferior turbinates of the nose.

Disorders of the Human Skull. Possibly the commonest skull disease attacking humans is sinusitis. Cavities, which are lined with mucous membrane and which are known as sinuses, normally occur in the frontal bones, the sphenoid bones, the maxillary bone, and the mastoid processes of the temporal bone. Each of these sinuses opens into the nasal cavity. Sinuses are often infected by bacteria, causing inflammation and increased secretion of the mucous membranes and producing severe pain. Acute sinusitis is treated with antibiotics such as penicillin; however, in many persons sinus inflammation becomes chronic and is extremely difficult to eradicate. See also MASTOID PROCESS.

Skull deformity occasionally occurs in the womb or during delivery and is often accompanied by brain damage. The skull is also subject to fracture (q.v.) and to tumors; see CANCER. For skull measurement, see INDEX, CEPHALIC.

SKUNK, common name of a genus, *Mephitis*, of small carnivorous quadrupeds of the family Mustelidae. The body is elongated, and usually considerably arched; the tail long, and thickly covered with long, fine hair; the head small, with thick, blunt snout; the legs short, and the

paws comparatively large, with five incompletely divided toes. All the species are American, and, as they differ little in habit, the common skunk, *M. mephitis*, may be taken as typical of the whole genus. The common skunk, an animal about the size of a cat, has fur of a glossy black; on the forehead is a patch of white diverging into two lines, which extend the whole length of the back and meet again in the bushy tail. All have nocturnal habits and are noted for excessive development of the anal glands, from which an acrid discharge may be sprayed a considerable distance. This discharge is the chief defense of the skunk against his enemies, and its distinctive odor is proverbial. Skunks are trapped for their fur, which is sometimes sold as "Alaska sable". Compare POLECAT. **SKUNK CABBAGE**, common name for a plant, *Symplocarpus foetidus*, of the arum family (Araceae), growing in swamps and moist ground from Nova Scotia to Florida and west to Missouri and Minnesota. The hooded, shell-shaped, rather fleshy, variegated purplish spathe appears in earliest spring before the smooth, ovate or heart-shaped leaves. All parts of the plant, especially when bruised, emit a fetid skunkish odor. The fruit, which ripens in September, is a roughened globular mass 2 or 3 in. in diameter. It is also called swamp cabbage. See ARUM.

SKYDIVING, sport of parachuting, an outgrowth of military and stunt parachuting. The development of new jumping techniques that increase the safety of the jump and the stability of the parachutist in the air, and of steerable parachutes of improved design have contributed greatly to the popularity of the sport. A first jump can be made safely after three hours of professional instruction.

A modern skydiving parachute is made with slits and holes in the canopy and deeply scalloped edges, so that most of the shock of opening the parachute is eliminated. This design produces a slightly oblique instead of a vertical descent. By manipulating the shroud lines that attach the parachute harness to the canopy, the parachutist can alter both his forward speed and his rate of descent.

Skydiving emerged as an international sport in 1951, when competitors from five countries met in Yugoslavia in the first world championships. This first competition was limited to accuracy in landing on target. Later, as skydivers learned to guide their descent in free fall, a so-called style event was added to international competitions. In this event the contestant is required to perform figure eights in the air, that is, alternate 360° turns to the right and left, fol-



Maneuvers in skydiving. Above: A parachutist exits for a free fall. Below: Spreading his arms and legs for stability, the skydiver arches his body in order to keep his center of gravity toward earth and to fall in a stable face-to-earth position.



SKYE

lowed by back loops. This feat takes from 20 to 30 seconds. The parachutist is judged on the accuracy of his maneuvers and the speed with which he completes them; the faster the maneuvers, the greater the difficulty of maintaining control. More than thirty countries participate in world championships, which are held every two years and include both accuracy and style events. The sport is regulated by the International Parachuting Commission of the International Aeronautical Federation. The representative of the federation in the United States is the U.S. Parachute Association.

The first private parachuting center was established in the U.S. in 1959, in Orange, Mass. An estimated 1,000,000 jumps are made annually by some 50,000 persons in the U.S.

See also PARACHUTE.

SKYE, Great Britain, island of Scotland, in Inverness County, the largest of the Inner Hebrides, separated from the mainland by a narrow channel. Skye is 670 sq.mi. in area and mostly mountainous, rising to a height of 3310 ft. in the Cuillin Hills. The chief occupations are fishing and sheep and cattle raising. A popular tourist resort, Skye is the site of the castle of the Macleods, erected in the 9th century. The capital of the island is Portree. Pop. (1971) 7364.

SKYE TERRIER, breed of terrier that originated many centuries ago in the Isle of Skye, an island of the Inner Hebrides group off the northwestern coast of Scotland. The dog became a pet for the English aristocracy about the middle of the 16th century, and was generally popular in England and the United States until about the beginning of the 20th century; since that time the dog has been superseded in popularity by other breeds of terrier (q.v.). The Skye terrier has a long and massive head; ears that are either erect

("prick") or hanging ("pendant"); hazel-colored, medium-sized eyes that are set close; short straight legs; a low body, 9 in. high at the shoulder in the male and 8 in. in the female, and 41 in. long in the male and 39 in the female; and a tail about 9 in. long. The dog weighs from 14 to 20 lb. It has a double coat, an undercoat of soft, woolly hairs, and an outer coat of hard, straight hairs which are about 5 in. long; the hair growing on the head falls over the forehead and eyes. In color the dog is either light or dark gray or blue, or is fawn with dark points.

SKYLARK, European lark, *Alauda arvensis*, of the family Alaudidae, the lark of Great Britain, a universal favorite because of the sweetness of its song. It abounds in open, cultivated or grass-land districts and is common in most parts of Europe, but from the north it migrates southward before winter. It is native to Asia and a winter visitant to northern Africa. It makes its nest generally in an open field and often under shelter of a tuft of herbage or a clod of earth, lays three or four mottled eggs, and generally produces two broods in a season. It is not gregarious in summer, but in winter large flocks assemble.

See also LARK.

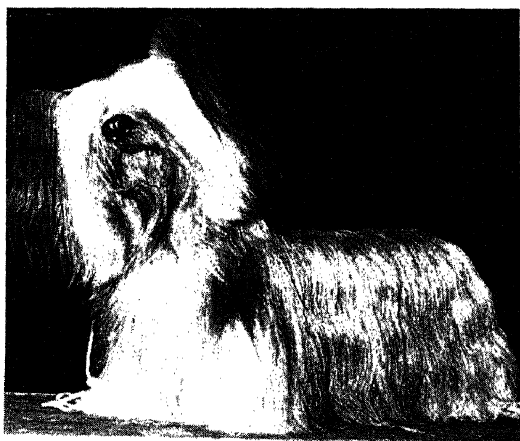
SKYSCRAPER. See AMERICAN ARCHITECTURE: *Modern American Architecture*; BUILDING CONSTRUCTION.

SLAG, impure residue, consisting largely of calcium, iron, aluminum, and magnesium silicate, derived during the process of pig-iron and steel production and during the smelting of metals such as copper, lead, and nickel (qq.v.). See IRON AND STEEL MANUFACTURE: *Pig-Iron Production*; METALLURGY.

SLANDER, in the law of torts (see TORT) in England and the United States, oral defamation or use of the spoken word to injure another's reputation, as distinguished from libel (q.v.) or written defamation. To be the basis of a legal action a publication of the words complained of, that is, their utterances in the hearing of third persons, must demonstrably have taken place. Among statements considered slanderous per se are those that impute the commission of a felony (q.v.), as by calling an individual a forger or murderer; that impute an individual to be suffering from an offensive disease, such as leprosy or syphilis; or that are injurious to an individual in his trade or profession, as by calling a doctor a quack. When the reputation of the injured party is not presumed to have been injured by the statement itself, the plaintiff must allege in his pleading special damage or loss suffered as a result of the statement.

Skye terrier

UPI



The party charged with the slander may hold, as a defense, that the words spoken were in fact true, inasmuch as true statements result in no injury to reputation. Definition of slanderous language is sometimes difficult. The disputed words themselves may not be slanderous but may hold a hidden meaning, or innuendo, which hearers may apprehend and which may therefore result in damage to the reputation of the slandered party. A defendant in a slander action cannot claim as a defense that another party had made the slanderous statement and that he was merely repeating the statement; nor can he claim that he gave the name of his informant and expressed no opinion as to the truth. In some cases words that would otherwise be considered actionable, or subject to laws of slander, may be uttered as a privileged communication. Speeches in the Congress of the United States (q.v.) or in a State legislature, or statements by lawyers in the course of legal proceedings, are examples of such immunity (q.v.).

Suits for slander, applicable only to public figures, have become increasingly rare in the U.S. because of recent high court rulings, in some States, that in such cases malicious intent must be proved.

See DEFAMATION.

SLANG, substandard words and usages which tend to be nationwide rather than restricted to a locality; *corny* and *like a cigarette should* are slang, while *nary* and *them dogs is us'uns* (those dogs are ours) are dialectal; compare DIALECT. Slang differs from jargon (q.v.), the speech of a particular group or calling, and from cant, the special language of the underworld, often designed to be unintelligible to outsiders. The boundary line between colloquialisms, vulgarisms, slang, jargon, and cant is not always easy to draw, and words and forms tend to pass from the more restricted to the broader classifications, become generalized, and sometimes go on into the standard language. The term slang, variously said to be derived from an imaginary past form of "sling", or from "slanguage", first appears in the mid-18th century, but literature on the subject goes back to at least two centuries earlier.

Formation of Slang. Slang is subject to the same processes that characterize standard language. One method is borrowing from foreign sources, as *boloney* (Ital. *Bologna*) for a food coming from Bologna, or *crank* (Ger. *krank*, "sick person") for an ill or, sometimes, a grouchy individual. Another method is to extend the meaning of a well-known word, as *bean* (head). Slang may also derive from anal-

ogy, as *his'n* (based on the final *n*-sound of "mine"), or it may simply be invented or coined, as *oomph* (sex appeal) and *gimmick* (gadget).

One characteristic of slang is its overproduction of many terms for the same thing. No fewer than 200 slang terms are claimed to exist for "drunk" or "intoxicated", for example, *under the weather*, *pixillated*, *soused*, and *stoned*. Another feature of slang is that it may be extremely short-lived, as the expressions *kiddo*, *23-skiddoo*, *natch*, and *how horrible can you get?*, all familiar to past generations but practically unknown today.

Abbreviations are a frequent source of slang and colloquialisms, for example, *mike* (microphone) and *flu* (influenza), and even of terms now standard, such as *bus* (omnibus) and *wig* (periwig). Abbreviations also lend themselves to local divergences, as the British *fridge* (refrigerator) or *tellie* (television). American English tends to borrow foreign prefixes and suffixes and use them in slang words, ultimately passing them on to British usage. Examples include the derogatory Yiddish *schm-*, *schn-*, *schl-*, as in *schmo*, *schnook*, and *schlemiel* (foolish persons), and the Russian Yiddish *-nik* as in *beatnik* (an unconventional person) and even *Sfnik* (a science fiction writer).

In many countries a younger-generation slang exists that tends to be nationwide but is largely not understood by older people. Examples in the United States are *pot* (marijuana), *pad* (one's home), *rumble* (fight), *to waste* (to kill people), and *to trash* (to destroy things). Here slang borders on jargon.

Geographical Expansion. At a period when innovations are accepted rapidly due to transportation and communications media, terms originating in one area easily spread to the point of becoming nationwide slang. Such widespread acceptance happened to *tailgating* (driving too closely behind another vehicle) and *pizzazz* (flamboyance). Similarly, *cat* (a sport), *cool* (aloof), *Mr. Charley* (white man), *The Man* (the law), and *Uncle Tom* (a meek Negro), all of which originated in the predominantly Black district of Harlem in New York City, have traveled far since their inception.

Slang may pass from region to region in many ways. At present, its milder aspects are spread by the news media and the language of advertising, for example, *coffee-er* and *macaroniest*. The cant of the criminal classes is often turned into slang by novels and TV programs, as *five grand* (\$5000), *gat* (revolver or pistol), *to heist* (to steal), *getaway*, *stickup*, and *Big House* (penitentiary).

Linguistic Importance. Slang appears at all times and in all languages; Sanskrit, for example, used *kapala* ("dish") and Latin used *testa* ("pot") in the sense of "head". At all historical periods also slang forms have gained acceptance into the standard language. Slang terms brought into acceptable usage by the English playwright William Shakespeare include *hub-bub*, *fretful*, *to bump*, and *to dwindle*. Such forms as *strenuous*, *clumsy*, and *educational* were at one time condemned and avoided by the purists, linguists advocating strict adherence to correct usage. More modern terms, like *to goof* (to blunder), *snafu* (a mistake), *behind the eight ball* (in a losing position), and *I've had it* (I'm exhausted) are gaining acceptance today. Definitely here to stay and of significant value in man's communication system, slang remains under the watchful eye of modern linguists.

M.P.

SLATE, dense, fine-grained, fissile rock, formed by the metamorphism of shale or clay, or more rarely of igneous rocks. The process of metamorphism (see **GEOLOGY: Petrology**) results in consolidation of the original rock and in formation of new cleavage planes along which slate characteristically splits into thin, broad sheets. Many rocks that show "slaty cleavage" are by extension loosely called slate. True slate is hard and compact and does not undergo appreciable weathering. The basic minerals comprising slate are quartz (q.v.) and muscovite, a kind of mica (q.v.); biotite, chlorite, and hematite (q.v.) are often present as accessory minerals, and apatite, graphite, kaolin, magnetite, tourmaline, and zircon (qq.v.) may occur as minor accessory minerals. Slate is commonly bluish black or gray black in color, but red, green, purple, and variegated varieties are known. In the United States the most important slate quarries are in Pennsylvania, Vermont, New York, Maine, and Maryland. In Europe slate is quarried in Wales, France, and Germany. Slate is quarried usually in open pits and rarely in underground workings. The rock splits best when it is "green" or freshly taken from the quarry. Slate is employed as a roofing material and for paving stones, flooring, blackboards, and writing slates.

A.M.B.

SLATER, Samuel (1768–1835), American cotton producer, born in Belper, England. At the age of fourteen he was apprenticed to the British inventor of cotton-spinning machinery Sir Richard Arkwright (q.v.); see also **SPINNING**. Slater became highly knowledgeable in improved textile machinery. When Great Britain, for monopolistic reasons, forbade textile workers from leaving

the country and the United States offered bounties for textile information, he emigrated in disguise to the U.S. He had memorized information on textile techniques and machine specifications. In Providence, R.I., he began to build and operate Arkwright cotton machinery and, in 1790, opened the first important spinning mill in the U.S. in Pawtucket, R.I. He is hence recognized as founder of the cotton industry in the U.S., and also as a pioneer of the factory system; see **FACTORIES AND THE FACTORY SYSTEM**. The Sunday school he established in 1796 for his workers was one of the first such programs in the U.S. **SLAUGHTERHOUSE CASES**, term applied to post-Civil War legal cases in which a majority decision of the Supreme Court of the United States (q.v.) upheld State legislative and police rights, rather than plaintiffs' interests as U.S. citizens, despite the "due process" provisions of the earlier adopted Fourteenth Amendment of the Constitution of the United States (q.v.). The litigation grew out of State monopolistic measures and subsequent unemployment, in Louisiana. Some hundred of suits were involved in the controversy, of which the one (*Butchers' Benevolent Association vs. Crescent City Livestock Landing and Slaughter-House Co.*) ruled on by the Supreme Court represented a test case.

In 1869 the legislature of the State of Louisiana monopolized, purportedly for public health reasons, the slaughtering business in the city of New Orleans in a single area under a single corporation. This action resulted in the loss of work for several thousand people employed by independent slaughterhouses. The butchers challenged the constitutionality of the State law as a violation of the "privileges and immunities" guaranteed citizens by the Fourteenth Amendment. Crucial in the suits (*The Slaughter-House Cases*, 16 *Wallace*, 36) was the interpretation of the Amendment, which had been ratified in 1868 to guard the rights not only of Negro freedmen but of all citizens and private businesses on a Federal basis. In 1873 the Supreme Court, by a vote of five to four, ruled against the complaint of the Butchers' Benevolent Association and did not invoke the Amendment; one of the dissenters was Chief Justice Salmon Portland Chase (q.v.). In rendering the controversial decision, Associate Justice Samuel Freeman Miller (1816–90) stated that the purpose of the Amendment was fundamentally to protect the rights of Negroes, not to arrogate to the Federal government the entire domain of civil rights in the separate States; and thus that it did not apply to the economic deprivation in question, which was a matter of State, rather than citizenship.

The slaughterhouse cases are historically important because they first posed the problem of defining State citizenship as against U.S. citizenship. The support that the ruling gave to State powers was short-lived, and the Fourteenth Amendment later gradually became a basis for broader Federal power in protecting the interests of private citizens.

See CIVIL RIGHTS AND CIVIL LIBERTIES; DUE PROCESS OF LAW. R.E.Bu.

SLAVE COAST, geographical name for that section of the w. coast of Africa lying n. of the Gulf of Guinea along the Bight of Benin between present-day Ghana and the mouths of the Niger R. It includes the coastal areas of present-day Togo, Dahomey, and Nigeria. The western African slave trade formerly centered in the region; see SLAVERY.

SLAVERY, social institution defined by law and custom as the most absolute and involuntary form of human servitude. The definitive characteristics of a slave are as follows: his labor or services are gotten through force; his physical being is regarded as the property of another man, his master; he is entirely subject to his master's or owner's will. Since earliest times the slave has been legally defined as a thing; therefore, he could among other possibilities be bought, sold, traded, given as a gift, or pledged for a debt by his master, usually without any recourse to personal or legal objection or restraint. Compare PEONAGE; SERFDOM; WHITE SLAVERY.

The practice of slavery undoubtedly is prehistoric, although its institutionalization probably first occurred in early historical times when agricultural advances made possible more highly organized societies. Slaves were needed for various specialized functions in these societies and were obtained either through raids or conquests of other peoples or within the society itself, when men sold themselves or their family members to pay debts or were enslaved as punishment for crimes.

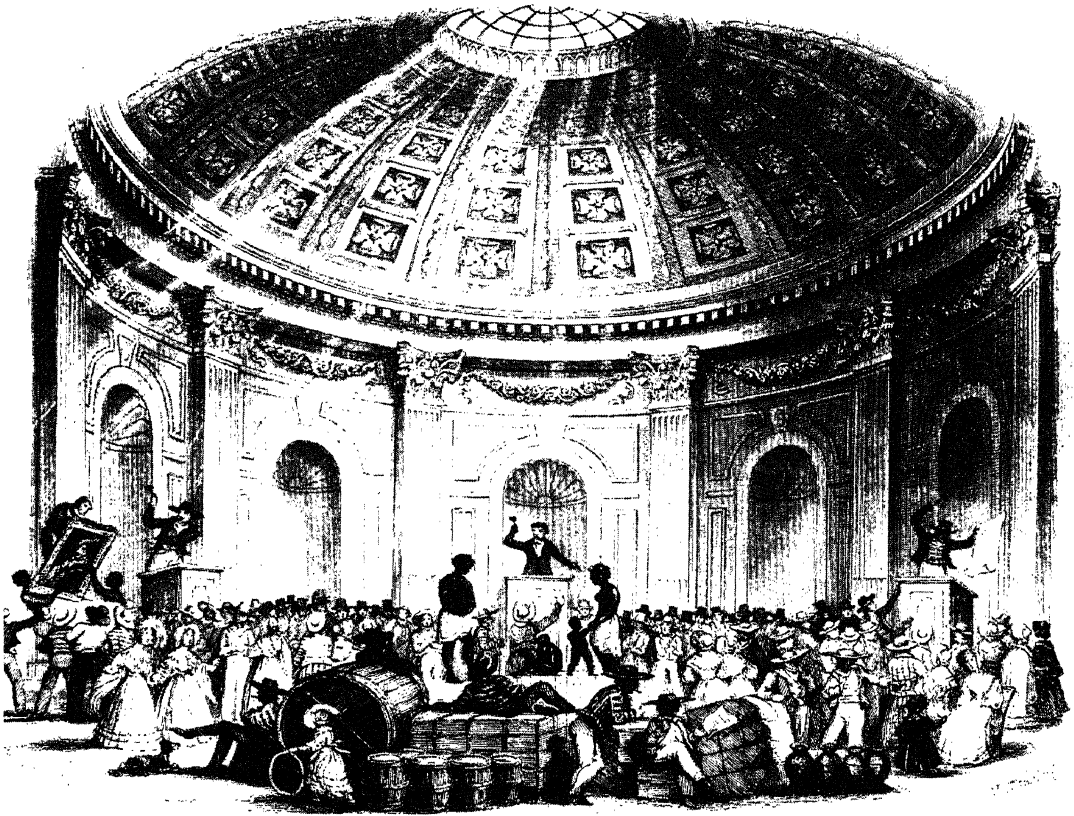
Ancient Period. Slavery was an accepted feature, often quite basic to the economy and society, of all ancient civilizations. The ancient Mesopotamian, Indian, and Chinese civilizations employed slaves, either domestically in homes and shops or in gangs for large-scale construction or agriculture. The ancient Egyptians used slaves on a mass scale to build the royal palaces and monuments. The ancient Hebrews (q.v.) also used slaves, but were required by religious law to free slaves of their own race at certain fixed times. In the more advanced civilizations of pre-Columbian America, for exam-

ple those of the Aztec, Inca, and Maya (qq.v.), slave labor was also utilized on a large scale in agriculture and warfare.

In the Homeric epics (see HOMER), slavery is the ordinary destiny of prisoners of war. The later Greek philosophers did not consider the condition of slavery as morally objectionable, although the Athenian philosopher Aristotle (q.v.) went so far as to suggest that faithful slaves might be freed in reward for loyal service. With few exceptions, slaves in ancient Greece were humanely treated. The Helots (q.v.) of Sparta, descendants of an earlier, conquered race of inhabitants who were forced to labor on large estates and to fight with the Spartan armies, were severely treated, however, mainly because they far outnumbered their dependent masters. More typically slaves were employed in domestic service, in trades, as laborers on country estates, and as seamen and oarsmen. Where they were employed in private domestic service, it was not uncommon to find them on friendly terms with their masters.

Roman slavery differed in several important particulars from that of ancient Greece. Roman masters had more power over their slaves including, by law, the power of life and death. Also, slavery was far more essential to the economy and social system of Rome, especially after the empire, than it had been in Greece. Wealthy Romans, often maintaining large city and country homes, depended on numerous slaves for the efficient operation of these households. Imperial conquests and expansion eventually strained the native Roman manpower resources so that great numbers of foreign slaves had to be imported to fill agricultural labor needs. The chief way of acquiring slaves was through war; tens of thousands of captured prisoners of war were brought to Rome as slaves. Other sources of slaves were debtors, who sold themselves or members of their families into slavery, and persons convicted of serious crimes. Ultimately, Rome's dependence on slavery contributed significantly to her downfall.

Slavery in the Middle Ages. The introduction of Christianity (q.v.), its adoption as the official religion of the Roman Empire, and its subsequent spread over Europe and parts of the Middle East during the Middle Ages tended to ameliorate the conditions but did not eliminate the practice of slavery. After the fall of Rome, during the barbarian invasions that occurred at various times between the 5th and 10th centuries, the ancient institution of slavery was transformed into the generally less binding system known as serfdom; see FEUDALISM.



In the South, slaves (center) were sold at public auction until the Civil War ended slavery in the U.S.

Library of Congress

Islam (q.v.), established in the 7th century, recognized the institution of slavery from the beginning. The prophet Muhammad (q.v.) urged his followers to use slaves kindly, however, and on the whole slaves owned by Muslims were comparatively well treated. Most of them were employed as domestic servants.

Modern Period. The coastal exploration of Africa and the discovery of North and South America by Europeans in the 15th century, and the subsequent colonization of the Americas during the next three centuries provided the impetus for the modern slave trade. Portugal, lacking in agricultural manpower, was the first modern European nation to meet her labor needs by importing slaves. The Portuguese began the practice in 1444; by 1460, they were annually importing 700 to 800 slaves to Portugal from trading posts and forts established on the African coast. These were Negroes captured from western Africa. Spain soon followed, but for more than a century, Portugal virtually monopolized the African traffic. Throughout the 15th century Arab traders in northern Africa shipped Negroes

taken from central Africa to markets in Arabia, Persia, and India.

In tropical Latin America during the 16th century, Spanish colonists first forced the native Indian populations to work the land. The Indians, however, could not survive under conditions of slavery and were nearly exterminated. Negroes from Africa were then brought to the Spanish colonies, chiefly because it was believed that they could endure forced labor in the generally more enervating Caribbean and mainland Latin American climates.

England entered the slave trade in the latter half of the 16th century, contesting the right to supply the Spanish colonies held until then by Portugal. France, Holland, Denmark, and the American colonies themselves subsequently entered the trade as competitors. In 1713 the exclusive right to supply the Spanish colonies was granted to the British South Sea Company (q.v.).

In North America the first Negroes landed at Jamestown (q.v.) in 1619. Brought by early English privateers, they were not reduced to slavery, but to limited servitude, a legalized status of Indian, white, and Negro servants preceding slavery in most, if not all, of the English colonies in

the New World. The number of slaves imported was small at first and there was little need for definition of their legal status. Statutory recognition of slavery, however, occurred in Massachusetts in 1641, in Connecticut in 1650, and in Virginia in 1661; these statutes dealt mainly with fugitive slaves.

With the development of the plantation system in the Southern colonies in the latter half of the 17th century, the number of Negroes imported as agricultural slave laborers increased greatly, and several Northern coastal cities became centers of the slave traffic. Generally, in the Northern colonies, slaves were used as domestics and in trade; in the Middle Atlantic colonies they were used more in agriculture; and in the Southern colonies, where plantation agriculture was the chief occupation, almost all slaves were used to work the plantations.

As Negroes became an increasingly important element in the English colonies in America, particularly in the South where they were fundamental to the economy and society, the laws affecting them were modified. By the time of the American Revolution, they were no longer indentured servants but slaves in the fullest sense of the term; and laws defining their legal, political, and social status with respect to their masters were quite specific regarding these matters.

Contrary to what is commonly believed, slaves did have some legal rights, such as support in age or sickness, a right to limited religious instruction, and the right to bring suit and give evidence in special cases. Custom gave numerous rights also, such as private property, marriage, free time, contractual ability, and to females domestic or lighter plantation labor, which, however, the master was not bound to respect. Barbarities such as mutilation, branding, chaining, and murder were regulated or prohibited by law, but instances of cruelty were common before the 19th century.

Abolition of Slavery. The United States of America and Great Britain both abolished the slave trade in 1807. Denmark, however, had been the first to abolish the trade, in 1792. At the Congress of Vienna in 1814, Great Britain exerted her influence to induce other foreign powers to adopt a similar policy, and eventually nearly all the states of Europe passed laws or entered into treaties prohibiting the traffic. The Ashburton Treaty of 1842, between Great Britain and the U.S., provided for the maintenance by each country of a squadron on the African coast to enforce prohibition of the trade; and in 1845 a joint cooperation of the naval forces of England and France was substituted for the mutual

right of search. The limitation of supply of Negroes led, among other ameliorating results, to a greater attention on the part of the masters to the condition of their slaves.

The French emancipated their slaves in 1848. The Dutch slaves had freedom conferred on them in 1863. Most of the new republics of South America provided for the emancipation of slaves at the time of their establishment. In Brazil slavery was not abolished until 1888.

Slavery in the United States. The history of Negro slavery in the U.S. is partly dealt with under NEGROES IN THE UNITED STATES. The steps that hindered or prepared the way for its final abolition, 1863–65, are part of the history of the U.S., and are dealt with in such special articles as ABOLITIONISTS; BROWN, JOHN; GARRISON, WILLIAM LLOYD; LINCOLN, ABRAHAM; MISSOURI COMPROMISE. It may be noted that in 1800 there were in the U.S. 893,602 slaves, of which only 36,505 were in Northern States; and that Vermont, Pennsylvania, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey provided for the emancipation of their slaves before 1804, most of them by gradual measures. The 3,953,760 slaves at the census of 1860 were in what were known as the Southern States.

Eminent statesmen from the earliest period of the national existence, for example George Washington, Benjamin Franklin, Thomas Jefferson, James Madison, John Jay, and Alexander Hamilton (qq.v.), regarded slavery as evil and inconsistent with the principles of the Declaration of Independence. The Society of Friends uniformly opposed slavery, and agitated against it; see FRIENDS, SOCIETY OF. The Presbyterian Church made several formal declarations against it between 1787 and 1836; see PRESBYTERIANISM: *Presbyterianism in America*. The Methodist Episcopal Church always cherished strong antislavery views, but in 1844, when one of its bishops was suspended for refusing to emancipate slaves he had inherited through his wife, a secession took place and the Methodist Episcopal Church, South was formed; see METHODIST CHURCH, THE. Individuals and groups of persons of almost all sects were found defending slavery. On the whole, antislavery views grew steadily; but many of those who personally held strong antislavery opinions hesitated to join actively in abolitionist agitation, unwilling to invade what many of their fellow citizens held to be their indisputable rights. To this halting attitude the Civil War put an end.

Slavery in the 20th Century. An important achievement in the struggle against slavery was the adoption of the International Slavery Con-

SLAVE TRADE

vention in 1926 by the League of Nations (q.v.). This convention provided for the suppression and prohibition of the slave trade and complete abolition of slavery in all forms. The convictions embodied in the convention were reaffirmed by the Universal Declaration of Human Rights, adopted by the United Nations (U.N.) in 1948.

In 1951 a U.N. committee on slavery reported that the practice of slavery was declining rapidly, with only a vestige of slavery remaining in a few backward areas of the world. Nevertheless, the committee found that forms of servitude similar to slavery affected a large number of people. These types of servitude include forms of serfdom and peonage, various abuses arising from the adoption of children, and the transfer in marriage of women without their consent. At the recommendation of the committee a conference representing fifty-one nations was held in Geneva, Switzerland, in 1956. The conference adopted a Supplementary Convention on the Abolition of Slavery, the Slave Trade, and Institutions and Practices Similar to Slavery to supplement the convention of 1926. The new convention condemns forms of servitude similar to slavery and provides for penal sanctions against the slave trade. Any disputes relating to the convention are to be referred to the International Court of Justice (q.v.).

SLAVE TRADE. See SLAVERY; NEGROES IN THE UNITED STATES: *History*.

SLAVIC LANGUAGES or **SLAVONIC LANGUAGES**, branch of the Eastern or Satem division of the Indo-European family of languages (see INDO-EUROPEAN LANGUAGES), spoken principally by the Bulgarians, Czechs, Poles, Russians, and Yugoslavs. See BULGARIAN LANGUAGE; CZECH LANGUAGE; POLISH LANGUAGE; RUSSIAN LANGUAGE; SERBO-CROATIAN.

SLAVONIA. See CROATIA.

SLAVS, people living in eastern, southeastern, and central Europe and speaking one of the languages belonging to the Slavic branch of the Indo-European language family; see INDO-EUROPEAN LANGUAGES. The Slavs are usually divided into three linguistic groups. The eastern Slavs speak Belorussian, Russian, or Ukrainian; the western Slavs speak Czech, Polish, or Slovak, and the southern Slavs speak Bulgarian, Macedonian, Serbo-Croatian or Slovene.

Today Slavs comprise the predominant population of Bulgaria, Czechoslovakia, Poland, the Soviet Union, and Yugoslavia. The territory occupied by Slavs before the Christian era appears to have been the region of the Carpathian Mts. By the 6th century the Slavs had spread into the Balkan Peninsula, the Byzantine Empire, and

Germany. From the 8th century on the Germans, Magyars, Tatars, and Turks pressed back the Slavs, and in the course of centuries many Slavic peoples lost their independence. By the 19th century only the Russians were independent.

In religion the western Slavs and Croats and Slovenes are traditionally Roman Catholics, while the southern Slavs, excepting the Croats and Slovenes, and the eastern Slavs are traditionally Eastern Orthodox.

SLEEP, recurrent physiological state of man and other animals, particularly vertebrates, characterized by the loss of consciousness and a very marked slowing of the various functions of the mind and body. Periods of sleep are necessary for the preservation of life and during such periods the body apparently recuperates from the effect of waking activity.

Many theories have been advanced to explain the physiological causes of sleep. One theory proposes that sleep is caused by the accumulation in the body of what are commonly called fatigue toxins, that is, poisonous substances which produce a feeling of great tiredness in the individual. Experimental evidence from the study of Siamese twins, however, suggests that the explanation cannot be so simple. Another theory proposes that sleep is regulated by a sleep center located at the base of the brain (q.v.) in the hypothalamus. Indeed, experimental evidence indicates that this center, together with another slightly forward in the hypothalamus, may be important regulators of transitions between sleep and wakefulness. Little is known, however, about the physiological processes which activate these centers.

Several important body changes occur during sleep. One of the most typical is a diminution in respiration. The rate of breathing is slowed and breathing is shallower than during wakefulness; circulatory activity is lessened and the heartbeat is markedly slowed. Other changes include lowering of the body temperature; relaxation of both the striated, voluntary skeletal muscles and the smooth, involuntary visceral muscles; and alterations of patterns of electrical activity in the brain. Although the muscles are relaxed during sleep, they are not all relaxed at the same time, and a certain amount of activity and movement occurs. Studies have shown that the average sleeper changes his position about once every seventeen minutes during his sleeping period.

In recent years, physiologists have used evidence from the electroencephalograph (E.E.G.), an instrument used for recording brain waves, to study the electrical activity of the brain during sleep. The E.E.G. shows four recognizable

stages of sleep, each with a characteristic brain wave pattern. Throughout the night, the individual moves back and forth from one stage to another. The most interesting stage is the one associated with the occurrence of rapid eye movements, known as REMS. It is only during this stage that dreaming occurs. REM sleep is characterized by a high degree of electrical activity in the brain together with an unusually relaxed state of the musculature. See DREAMING.

The amount of sleep necessary varies according to the individual and his age, decreasing as he grows older. Insomnia, or the inability to sleep, is often the result of emotional difficulties, particularly of anxiety. Although coffee and the drug caffeine (qq.v.), which is its active principle, are popularly supposed to inhibit or prevent sleep, experiments indicate that their sleep-inhibiting effects are exaggerated. Somnambulism (q.v.), or sleepwalking, and somniloquy, or talking in one's sleep, are common occurrences in childhood; when present in adults, these phenomena are considered to be of greater seriousness. D.Ka.

SLEEPING SICKNESS, or AFRICAN TRYPANOSOMIASIS, endemic and sometimes epidemic chronic disease caused by a blood parasite, *Trypanosoma*, of which there are three forms of varying virulence. Both wild and domestic animals, in whom the disease is called Nagana, are the reservoirs of the trypanosome which is carried from animal to animal and from animal to man. In epidemics, it is carried from man to man by the several varieties of the feeding tsetse fly, *Glossina*; see TSETSE. Tsetse flies flourish only in Africa and within a narrow range of temperature, humidity and flora. The flies bite painlessly, inject trypanosomes, and thus begins an incubation period of several months. The subsequent septicemic, or blood-poisoning stage, may last for many months and is characterized by headache and lymph node swelling; see LYMPH. After this comes the neurotropic stage, affecting nerve tissue, with eventual loss of appetite, malnutrition, severe motor changes of the central nervous system (see NERVOUS SYSTEM), somnolence, and ultimately death. These different stages can take up as short an interval as six months. Treatment of sleeping sickness is ineffective. Prevention depends on environmental control, particularly clearing away brush, and chemoprophylaxis; see CHEMOTHERAPY. Encephalitis (q.v.) from varying causes is also referred to popularly as sleeping sickness.

See also ENCEPHALOMYELITIS, EQUINE. D.S.T.

SLEEPY HOLLOW, valley in New York, in Westchester Co., at North Tarrytown. Crossed

by a small stream called the Pocantico R., the valley is famous as the scene of "The Legend of Sleepy Hollow" by the American writer Washington Irving (q.v.). Sleepy Hollow contains an old Dutch church, dating from 1697; Irving is buried in the churchyard.

SLEET, form of precipitation consisting of frozen rain. Particles of sleet are formed in cold weather when rain enters a layer of very cold air close to the ground, and freezes. Frequently, however, not all the rain freezes before reaching the ground, and some of the drops may be cooled considerably below the freezing temperature without freezing at all. Sleet is usually accompanied by freezing rain. When such rain falls on cold telephone wires or tree branches, it forms a coating of ice that is called glaze. See HAIL.

SLIDELL, John (1793–1871), American politician and diplomat, born in New York City, and educated at Columbia College (now Columbia University). In 1819 he moved to New Orleans, La., where he practiced law and embarked on a political career. In 1853 he became a United States Senator but resigned his seat in January, 1861, when Louisiana seceded from the Union. Later that year, after the outbreak of the Civil War (see CIVIL WAR, THE AMERICAN), he was appointed commissioner to France of the Confederate States of America (q.v.). Slidell sailed for Paris on the British mail steamer *Trent*, together with the Confederate commissioner to Great Britain James Murray Mason (1798–1871), who was enroute to London. Their ship was stopped at sea on Nov. 8, 1861, by the U.S. warship *San Jacinto*, commanded by the Union naval captain Charles Wilkes (q.v.). The Confederate envoys were arrested and confined in Fort Warren, Boston. When Great Britain threatened to declare war over the incident, the commissioners were allowed to sail for England on Jan. 1, 1862; see TRENT AFFAIR. Slidell's mission, which was to gain French recognition of the Confederacy, failed, however. After the war, he remained in Europe.

SLIDE RULE, mechanical device used largely by engineers and scientists for rapid and approximate multiplication, division, extraction of roots, raising to powers and other simple computations. The principle of the slide rule is the translation of all of these computations to equivalent additions or subtractions which can be carried out on a set of scales sliding over each other. Thus two uniformly graduated marked scales can be used for addition or subtraction as shown on Fig. 1 for $2 + 4 = 6$. If 2 and 3 are to be multiplied, it follows from the definition of logarithms (q.v.) that $\log 2 + \log 3$

SLIDE RULE

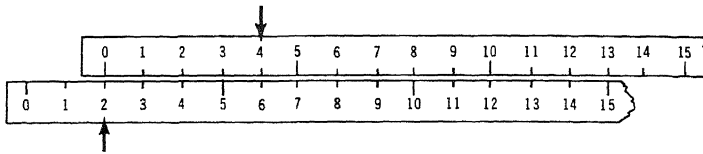


Fig. 1

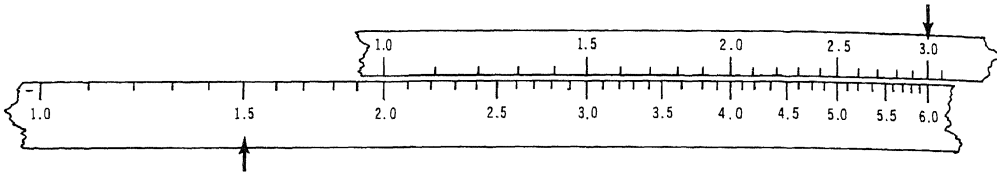


Fig. 2

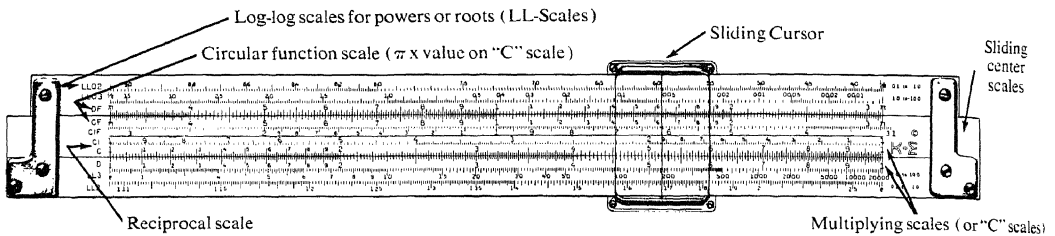


Fig. 3

Keuffel & Esser

$= \log 6$. Accordingly, a scale which is laid out logarithmically (Fig. 2) can be used to add (or subtract) logarithms and therefore to multiply or divide. Powers or roots (fractional powers) can be represented on a set of scales by a further extension of logarithms. Thus $4^2 = 16$ becomes $2 \times \log 4 = \log 16$. If the logarithm is taken once more $\log 2 + \log (\log 4) = \log (\log 16)$. Thus the combination of the normal (logarithmic) slide-rule scale with a so-called log-log scale leads to the evaluation of powers and roots. Other scales, such as for sine, cosine, tangent, logarithm and for calculations involving π are also found on the usual rectilinear slide rule. This consists of an upper and lower fixed part with various imprinted scales and a movable center slide on which further scales are given (see Fig. 3). A glass runner or cursor with a finely engraved vertical line is provided for easier alignment of the scales.

The computational accuracy possible depends on the size of the slide rule and on the care with which the scales are printed. The commonly used 10-in. slide rule permits multiplications and divisions to be made with an accuracy of about 1/10th percent, which suffices for many engineering calculations. Both the rec-

tilinear and the less commonly used circular slide rule were invented by the English mathematician William Oughtred (1574-1660) shortly after the discovery of logarithms. Various special slide rules have been devised for the solution of widely applicable engineering formulas, or for business calculations, such as the determination of interest, compound interest accumulation, and depreciation. *See also* COMPUTER; TRIGONOMETRY.

F.L.A.

SLIGO, maritime county of the Republic of Ireland, in Connaught Province, and bounded on the N. by the Atlantic Ocean and the Bay of Donegal. The coastline is indented with numerous bays and the interior is mountainous. The navigable rivers are the Moy, the Owenmore, and the Garroogue. The picturesque loughs Arrow and Gill are in this county. The chief occupations are farming and livestock raising. Coal, lead, and zinc are mined and some fishing is carried on. The county town is Sligo. Area, 694 sq.mi.; pop. (1971) 50,275.

SLIME MOLD. *See* MYXOMYCOTA.

SLING, device often used in the past as a weapon to discharge a stone or other heavy object with great force at a target. It usually consisted of two cords attached to a piece of leather on which the missile was placed. The attacker whirled the weapon above his head, im-

parting centrifugal force to it, before discharging the missile at the target. The Biblical Philistine giant Goliath (q.v.) was slain by a stone hurled from a sling by the young David. This weapon was used effectively in battle by the Greeks and Romans and continued in use until the Middle Ages, when the use of catapult (q.v.) and ballista became widespread against fortifications; see FORTIFICATION AND SIEGECRAFT.

SLOAN, John (1871–1951), American painter and etcher, born in Lock Haven, Pa., and educated at the Pennsylvania Academy of Fine Arts. He worked as an illustrator for newspapers and periodicals in Philadelphia and New York City and was an instructor at the Art Students League in New York City from 1914 to 1938, except for the year 1930–31, when he served as its president. Sloan was one of a group of outstanding American artists known as The Eight and also derisively as the Ashcan school because its members painted ruthlessly realistic scenes of city life. Sloan's paintings in the style of this school are especially noted for the vivid characterizations of people. He also painted scenes of American Indian life in New Mexico and numerous portraits and nudes. Among Sloan's best-known paintings are "McSorley's Bar" (before 1905, Detroit Institute of Arts) and "Backyards, Greenwich Village" (1914, Whitney Museum of American Art, New York City). He is the author of *Gist of Art* (1939). See AMERICAN PAINTING: 20th Century.

SLOAN FOUNDATION, ALFRED P., association established in 1934 by the American industrialist Alfred P. Sloan, Jr. (1875–1966) for general philanthropic purposes. Grants helped to establish the Sloan-Kettering Institute for Cancer Research in New York City and the Alfred P. Sloan School of Management at Massachusetts Institute of Technology (q.v.). Present interests are in science and technology, with a limited medical interest in cancer research; education, principally higher education; management; expanding professional opportunities for minorities; and related problems of society. In 1970 authorized grants and other expenses totaled \$16,879,039, and the market value of assets was \$318,856,804.

SLOE, or BLACKTHORN or SLOE THORN, a Eurasian shrub, *Prunus spinosa*, of the family Rosaceae, believed by some botanists to be the original species of some of the cultivated plums. It is generally a much branched spiny shrub 4 to 10 ft. high, or sometimes a small tree of 15 to 20 ft., with small snow-white flowers which appear before the leaves. The fruit is used for making preserves, brandy, and gin.

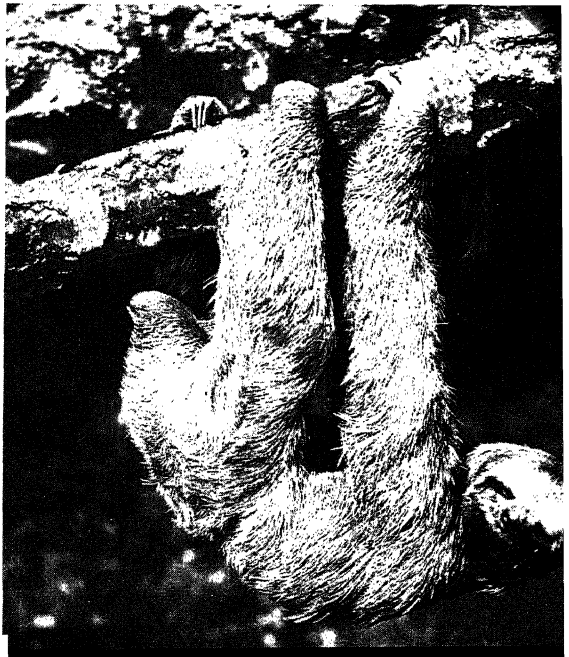
SLOOP, in modern usage, sailing vessel rigged with a single mast (q.v.) and carrying a single jib and mainsail. No universal distinction is made between a sloop and a cutter, although in general a cutter has its single mast placed further aft than that of a sloop and has a fore staysail as well as a jib forward of the mast. Sloops are usually Marconi-rigged; the vessels have a tall pole mast and a short boom. Almost all small modern yachts under about 30 ft. in length are sloop-rigged. In the days of naval sailing vessels, the term sloop referred to a full-rigged ship which was somewhat smaller in size than a frigate. The term is also applied to various types of powered naval vessels. For further information on the sails and rigs mentioned above, see SAIL.

SLOTH, common name applied to any of several arboreal mammals belonging to the order Edentata; the animals inhabit the tropical forests of South and Central America. They are divided into two groups: the three-toed sloths of the genus *Bradypus*, among which is the ai, *B. tridactylus*; and the two-toed sloths of the genus *Choloepus*, among which is the unau, *C. hoffmanni*. Sloths are usually about the size of a small dog. The flat, short head has large eyes, a snub nose, and rudimentary ears. The entire body is covered with grayish-brown, short hair. The tail is small in *Bradypus* and absent in *Choloepus*.

Sloths are relatively long-lived, sometimes living longer than ten years. They spend their entire existence hanging suspended from the

Three-toed sloth, *Bradypus tridactylus*

New York Zoological Society



SLOUGH

boughs of tree, with the legs and face turned upward and the back downward. The limbs are long and well developed, and terminate in long, curved claws which hook over and grasp the supporting bough. The forelimbs are longer, better developed, and more mobile than the hindlimbs. The animal moves by advancing one limb at a time in slow, deliberate fashion. Sloths rarely, if ever, descend to the ground voluntarily, and when placed on the ground they lie on their backs or crawl with the greatest difficulty.

The sloth sleeps during the day, curled up with the feet drawn close together and the head placed between the forelimbs. In this position the animal resembles a stump of a bough, and is relatively well camouflaged from the assault of natural enemies such as the jaguar (q.v.). An encrustation of green alga, which forms in the hair of some species and makes them indistinguishable from the surrounding foliage and moss, affords additional protection. The animal is habitually silent but sometimes utters a low, plaintive call. It feeds chiefly on foliage and shoots, which are pulled within reach of the mouth with typical slow movements. Each year the female produces a single offspring, which clings to the mother until it can take care of itself.

SLOUGH, Great Britain, municipal borough of Buckinghamshire, England, about 20 miles w. of London. After World War I the borough underwent rapid industrial growth and now is a center of light industry. The chief manufactures include aircraft parts, asbestos products, chemicals, and leather goods. Here the German-born astronomer Sir William Herschel (see under **HERSCHEL**) erected his great telescope (q.v.). Pop. (1971) 86,757.

SLOVAKIA, former province of Czechoslovakia, in the n.w. central part of the country. The province was abolished on Jan. 1, 1949, and in 1960 comprised the regions of Strždoslovenský, Východoslovenský, and Západoslovenský. The city of Bratislava (q.v.) is the former provincial administrative center. Before World War I Slovak people formed a national group, living chiefly in the n.w. portions of the former kingdom of Hungary. Under Hungarian rule and, later, that of the Austro-Hungarian Empire, the Slovaks were continually oppressed. After the collapse of Austria-Hungary, the Slovak National Council, on Oct. 30, 1918, declared its intention of uniting politically with the Czechs. Nationalistic aspirations of certain Slovak groups, however, persisted. On March 14, 1939, with the aid of Germany, the Slovak Diet proclaimed Slovakia an autonomous republic, and signed a military treaty with Germany. During World

War II, however, Slovakia was considered to be under German occupation. The state was dissolved in April, 1945, when it was liberated from German domination by Soviet and United States armies.

SLOVAKS, west Slavic people, closely akin to the Czechs, inhabiting the former province of Slovakia, Czechoslovakia. Their language, Slovak, is one of the official languages of Czechoslovakia. The Slovaks first inhabited Slovakia about the 5th century. The region was under Hungarian domination from the 10th century until 1918, when Slovak nationalism resulted in the joining of Slovakia with the Czech lands to form Czechoslovakia; see **CZECHOSLOVAKIA: History**. The Slovaks number more than 4,000,000. See also **CZECH LANGUAGE**; **SLAVS**.

SLOVENES or SLOVENIANS, south Slavic people living mainly in the republic of Slovenia, Yugoslavia; see **SLAVS**. Their language, Slovene, is one of the official languages of Yugoslavia. The Slovenes first inhabited Slovenia about the 6th century. In 1918, after centuries of subjugation by neighboring countries, they joined with the Serbs and the Croats to form Yugoslavia; see **CROATIA**; **SERBIA**. The present-day republic of Slovenia was established in 1946.

SLOVENIA (Slovene *Slovenija*), constituent republic of Yugoslavia, bounded on the n. by Austria, on the n.e. by Hungary, on the s.e. and s. by Croatia, and on the w. by Italy and the Adriatic Sea. Most of Slovenia lies within the Karst (It. *Carso*) plateau and the Julian Alps; Mt. Triglav (9393 ft.) is the highest point. Drainage, controlled by extensive forests, is provided by the Drava, Sava, and Mur rivers. Most of the people are Roman Catholic Slovenes. The Slovene language is closely related to Serbo-Croatian (q.v.) and has many dialects. Although Slovenia is the most urbanized Yugoslav republic, the only important cities are Ljubljana, the capital, and Maribor (formerly Marburg). Area, 7819 sq.mi.; pop. (1971) 1,697,499.

The most important economic activities in Slovenia are farming, dairying, and livestock raising. The main crops are cereals, potatoes, grapes, and tobacco. Among the main industries are iron- and steelworks, coal mining, lumbering, tobacco processing, and the manufacturing of glass, paper, and chemicals. Slovenia is also the winter tourist and sports center of Yugoslavia.

History. Under the Roman Empire, Slovenia was part of the provinces of Pannonia (q.v.) and Noricum. During the 6th century A.D., the region was invaded by the Mongolian Avars (q.v.) and later by Slavs who threw off Avar domination. A

period of intermittent domination by Bavaria ensued, with conversion of most of the people to Roman Catholicism. Late in the 8th century, the region became part of the Frankish Empire. In the 10th century it was reorganized as the duchy of Carantania by Otto I, Holy Roman Emperor (see *under* OTTO). During the 13th and 14th centuries, most of the Slovenes came under Hapsburg (q.v.) rule from Austria, and were subjected to the Germanizing of the upper orders of society. Until 1918, all Slovenes except for a minority included in the republic of Venice lived in the Austrian crown-lands of Carinthia, Carniola, and Styria (qq.v.). From 1809 to 1814, however, during the Napoleonic Wars (q.v.), the region was part of the Illyrian Provinces, taken from Austria by France. This brief period of liberal rule fostered an enduring Slovenian and South Slav nationalism that triumphed at the close of World War I, in 1918, with the formation of the Kingdom of Serbs, Croats, and Slovenes; see YUGOSLAVIA: *History*. In 1941, during World War II, the territory was divided among Germany, Italy, and Hungary. In spite of forced transfers of populations during the war, since 1945 most Slovenes have lived in the Slovenia Republic, which in 1947 also acquired Slovenian-speaking districts on the Adriatic Sea from Italy. Minorities of Slovenes still live in Austria and Hungary; many Americans are of Slovenian descent.

SLUG, terrestrial pulmonate gastropod or snail (q.v.), in which the shell is represented by an internal horny plate overlying the respiratory cavity. The slugs are chiefly of two families, Limacidae and Arionidae, and most commonly are of the genus *Limax*. They are vegetable eaters and often ascend trees in search of food and then let themselves down by means of a mucous thread, spun from a gland opening on the anterior edge of the foot. They may do extensive damage to cultivated plants, and are particularly damaging in greenhouses and truck gardens. The great gray slug, sometimes 4 in. long, is a European species, introduced into and now common in eastern North America. A native American slug, which is very common in the United States, is *Limax campestris*, a small species of slug less than 1 in. long. See GASTROPODA.

SLUTER, Claus (d. 1406), Dutch sculptor, born probably in Haarlem. After 1389 he was employed by Philip the Bold (q.v.), Duke of Burgundy. For him Sluter executed his famous "Well of Moses" (1395–1403) at the Carthusian monastery of Champmol in Dijon, Burgundy (now part of France). The work, which is still at the monastery, is a hexagonal pedestal with life-

sized figures of six Old Testament Prophets and patriarchs. Another masterpiece by Sluter, which is in the Dijon Museum, is the tomb (1404–06) of Philip the Bold, in black and white marble. One of the founders of the Burgundian school of art, Sluter sought to portray character realistically rather than to achieve a lyrical beauty. He is noted especially for his treatment of drapery and for the intense facial expressions of his figures.

SMALL ARMS, firearms that may be both carried and discharged by one man, as opposed to artillery weapons; see ARTILLERY. By extension, the automatic weapons that developed from such firearms are also called small arms; machine guns using the same ammunition as military rifles, as well as the larger caliber machine guns, are classified as small arms. Because the dividing line between small arms and artillery weapons is so vague, the various national military services have set arbitrary maximums on the caliber of the weapons to be regarded as small arms. These limits have been changed from time to time. Small arms are not subject to precise definition, but the term usually includes rifles, handguns (pistols and revolvers), shotguns, sub-machine guns, and machine guns.

HISTORY

The first small arms were developed as miniature models of early artillery weapons, and were at first called hand cannons; see CANNON.

Firelocks. In the first quarter of the 14th century the firelock was developed, a simple, smooth-bore tube of iron, closed at the breech end except for a touchhole, and set into a rounded piece of wood for holding under the arm. The tube was loaded with powder (see GUNPOWDER) and shot, and then fired by inserting a heated wire into the touchhole. Later models had a saucerlike depression, called a flashpan, in the barrel at the outer end of the touchhole; a small charge of powder was placed in the flashpan and fired by applying a so-called slow match (see MATCH). The slow match, consisting of a piece of cord soaked in a solution of potassium nitrate and then dried, smoldered without flaming or becoming extinguished. The charge of powder in the flashpan was difficult to ignite, was frequently affected by moisture in the atmosphere, and required repriming just before use to ensure against misfires. See FUZE.

Matchlocks. About the middle of the 15th century a type of musket called the matchlock was introduced. This weapon was essentially the same as the firelock, except that the slow match was clamped in the top of a device called a serpentine, an S-shaped piece of metal piv-

SMALL ARMS

oted in the center. Pulling with one finger on the bottom of the serpentine, as on a trigger, moved the top with the attached slow match into the priming pan, which contained the firing charge of gunpowder. Because only one finger was needed to fire the weapon, the matchlock left both hands free to hold and aim the firearm. A refinement in the shape of the stock of the matchlock to permit firing from the shoulder produced the *harquebus*.

Wheel Locks. About 1515 an improvement in the firing mechanism of small arms, called the wheel lock, was invented. It consisted of a spring-driven wheel, which when released by a trigger mechanism, rotated a hardened steel rim against a lump of iron pyrites, throwing a shower of sparks into the powder in the priming pan and thus firing the weapon. About the same time gunsmiths introduced the principle of rifled barrels; see *RIFLE*.

The wheel lock was too complicated and expensive for general acceptance; early in the 17th century, the *snaphance* was invented. This type of lock consisted of a hammer powered by a trigger spring and bearing a piece of flint (q.v.); when the trigger was pulled, the hammer struck the flint against a serrated steel striker plate located above the priming pan and thus produced a shower of sparks.

The final development of the flint-ignition firearm was the flintlock. It resembled the *snaphance*, except that the striker plate was L-shaped; the bottom limb of the L was used as a cover for the priming pan, to protect the powder from the elements until the upper limb was struck by the flint of the hammer. This action produced a shower of sparks when the powder in the pan was uncovered.

Flintlocks. The flintlock was the prevailing type of small-arms weapon for both shoulder guns and handguns from the end of the 17th century to the middle of the 19th century. Smoothbore flintlock muskets were the primary military weapon for infantry in the armies of the major European powers. In 1807 the British clergyman and inventor Alexander John Forsyth (1769–1843) invented the percussion-ignition system, making possible the development of successful breech-loading firearms, that is, firearms loaded through the rear of the barrel rather than through the muzzle. Many early 19th-century breechloaders used a cartridge containing only powder and ball; the weapon was usually equipped with a nipple holding a percussion cap that was fired by the impact of the hammer, or striker, when released by the trigger. In the 1850's the self-contained center-fire cartridges

came into use. Their design, with one-piece case, is essentially identical to modern center-fire types.

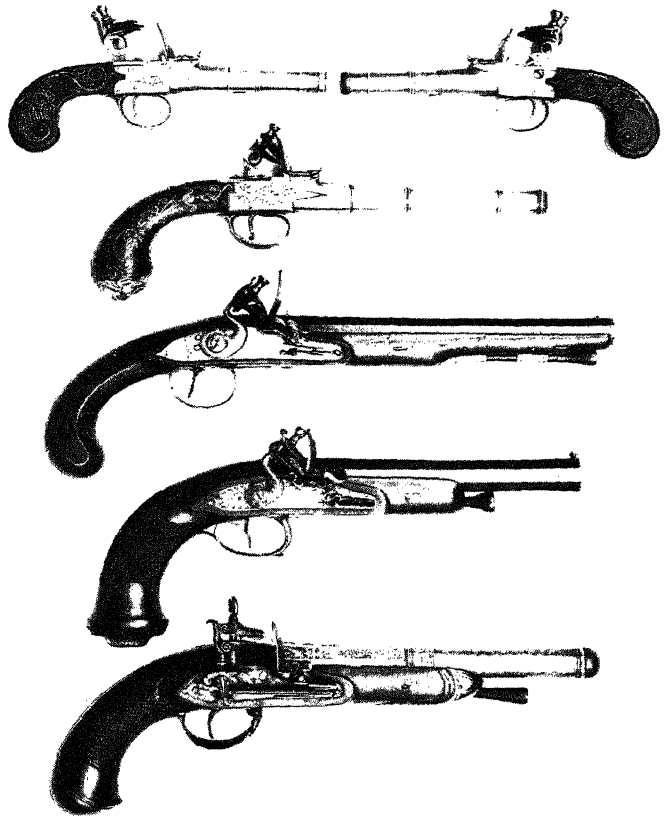
MODERN DEVELOPMENTS

In the 19th century, the design of small arms was revolutionized by the development of successful repeating rifles and the invention by the French chemist Paul Marie Eugène Vieille (1854–1934) of smokeless rifle powder, consisting of a colloided nitrocellulose in grains of controlled size and shape; see *EXPLOSIVES*. Smokeless powder, which permits the control of chamber pressures by variation in the size and form of the powder grains, allowed the development of increased muzzle velocities and improved ballistic qualities. High muzzle velocities necessitated the use of the jacketed bullet to prevent stripping of the bullet by the rifling; this bullet became standard in all rifled military small arms, and finally became required by international law. In 1888 the British army adopted the 0.303 caliber Lee-*Metford* repeating rifle, which was superseded by the Lee-*Enfield*. The United States Army used the 0.30 caliber Krag-Jorgensen rifle during the Spanish-American War, and later, in 1903, adopted the Springfield rifle, model 1903.

Repeating Weapons. The magazine rifles adopted by the armies of the great powers for military use were all bolt-operated; that is, they required manual operation of the bolt mechanism to extract the empty cartridge case and to insert a fresh cartridge from the magazine. During the early 20th century, preceding World War I, rifles were invented that used the forces of recoil or the pressure of the propellant gases to operate the reloading mechanism. Some of these improved weapons, fed with continuous belts of cartridges, were called machine guns, others, fed from large clips of cartridges or magazines, were called automatic rifles. Unlike the Lee-*Enfield* and Springfield-1903 military rifles, which require manual action to load after each shot, an automatic rifle continues firing until the magazine is exhausted, as long as the trigger is held. A semiautomatic rifle reloads and recocks automatically after each shot, but requires release and another pull of the trigger to fire each succeeding shot.

Automatic rifles were used to arm a limited number of so-called automatic riflemen in each infantry company during World War I; see *INFANTRY*. In the period between World War I and World War II, however, the United States adopted the Garand, or M1, semiautomatic rifle as standard equipment for all troops. Later, such troops as artillerymen, engineers, and signalmen

Types of small arms. Top to bottom: Miquelet flintlock pistols from 18th-century Spain. Queen Anne flintlock pocket pistol, made by Thomas Archer in London, England, about 1775. Queen Anne flintlock pistol, made by R. Edge in Birmingham, England, about 1725. English flintlock dueling pistol, made about 1800. French flintlock pistol, made about 1820. Parke-Bernet Galleries



were armed with the M1 carbine, of considerably less weight and range, but more suited to occasional use for defense. Late in World War II the carbine was modified to permit full automatic as well as semiautomatic fire. The M1 rifle operates by means of gas; a small port near the muzzle passes sufficient gas to propel a rod that operates the breech mechanism, ejecting the fired cartridge case and loading a fresh round from an eight-shot magazine. In 1957 the M14 rifle, with a twenty-round magazine, was adopted by the U.S. Army to replace the M1. The M16 rifle, which can be fired automatically or semiautomatically, was introduced in 1966, during the Vietnam conflict.

Many other small-arms weapons have been developed, both as regular equipment and for special services.

SMALL-ARMS AMMUNITION

The development of small-arms ammunition has been inextricably connected with the development of the guns that use it. In the early period of small-arms development, the powder, the

patch or wad, the ball, and the primer were carried separately and were loaded into the weapon separately. The powder was poured into the barrel through the muzzle, followed by the wad; then the bullet was rammed in, and the flashpan was primed with a small amount of powder. After the development of the flintlock, military forces began the preparation of measured charges before battle, wrapping the bullet and the proper amount of powder in a paper screw; the whole was called a cartridge. In combat, the end of the paper package was bitten off; the powder was poured into the barrel, and the bullet was rammed in, with the paper wrapper used as a wad. With the development of successful breech-loading guns, a metal cartridge containing a complete round was used. When the weapon was fired, the metallic case expanded during the combustion of the powder, preventing the escape of propellant gases through the breech, and contracted after the pressure dropped, permitting the easy extraction of the case.

SMALL BUSINESS ADMINISTRATION

Bullets. The first metallic cartridge generally adopted was the pinfire type. This was followed by the rimfire cartridge, which had a percussion explosive such as mercury fulminate primer mixture assembled in the hollow rim, or flange, of the case. The impact of the hammer of the weapon upon the flange of the cartridge case exploded the primer mixture, igniting the propelling charge of black powder. The rimfire type was superseded by the modern center-fire cartridge, in which the primer composition is contained in a soft metal cup assembled in a recess at the center of the base of the cartridge case and is connected with the propelling charge by a small vent.

Service bullets for modern military small arms were called balls because of the spherical shape of the earlier projectiles (see **PROJECTILE**); the shape of the modern bullet is that of a cylinder with a more-or-less conical tip. When the machine gun was developed, its use in spray fire required a method of fire control; the tracer bullet, which has a burning pyrotechnic pellet in the base, enables a gunner to observe the path of the bullet and to fire accurately.

During World War I, the development of armored vehicles, especially the tank (q.v.), forced the adoption of the armor-piercing bullet, in which the lead slug within a copper-nickel jacket was replaced by a hardened steel core capable of piercing the armor plate. Incendiary bullets were developed in the period between World War I and World War II to attack effectively the many gasoline-powered vehicles used in military operations, including tanks, armored cars, airplanes, and motor torpedo boats. By the end of World War II the U.S. military forces developed a bullet called the APIT (armor-piercing-incendiary-tracer), combining the properties of armor-piercing, incendiary, and tracer bullets.

See also **BALLISTICS**; **BAZOOKA**; **CARBINE**; **MACHINE GUN**; **PISTOL**; **REVOLVER**; **SHOTGUN**. J.S.C.

SMALL BUSINESS ADMINISTRATION, independent agency of the executive branch of the United States government, created in 1953. The functions of the administration are to make loans to small businesses unable to obtain financing from private sources on reasonable terms; to help small firms sell their products and services to the Federal government; to make loans to small business concerns affected by natural disasters; to license and regulate privately owned investment companies that make loans to small business concerns; and to develop and improve the managerial skills of prospective and current small-business owners. The

administration may make business loans of up to \$350,000.

The head of the administration is appointed by the President with the advice and consent of the Senate.

SMALLPOX or **VARIOLA**, acute, highly contagious biphasic viral disease (q.v.), often fatal. The virus generally enters the respiratory tract. After a 12-day incubation period the first phase of variola major is marked by high fever (q.v.), prostration, and toxicity. It is followed three or four days later by a macular rash, characteristically on the face and extremities, particularly the palms and soles of the feet; the trunk is affected minimally, if at all. A rash occurring early usually signals a severe case.

During the next six to ten days the rash becomes papular, then vesicular, and finally pustular. At the pustular stage, fever and toxicity return, initiating the second stage of disease. These pustules can become secondarily infected by bacteria (q.v.). As recovery begins, the pustules become crusted, often leaving scars, and the fever and toxicity subside. Death can be caused by infection of the lungs, heart, or brain.

Minor forms are variola sine eruptione and variola minor, known as alastrim. More severe forms are black and hemorrhagic smallpox. A person with smallpox of whatever form is infectious from about the third day through the erupting phase. During this period he may spread the disease to others directly, or indirectly through contact with clothing, cooking utensils, or other articles.

In 1967 the United Nations World Health Organization launched a worldwide vaccination campaign against smallpox; at the time, there were 10,000,000 to 15,000,000 cases of the disease a year and more than 2,000,000 deaths. By mid-1975, when all of India was declared free of smallpox, only a few cases were left in two countries, Bangladesh and Ethiopia, and these were under control. A search for hidden cases was expected to continue for several years, but scientists were almost certain that none would be found and that the smallpox virus, which can live only in the human body, would be eliminated from the world entirely, ending the need for vaccination.

See **CHICKEN POX**; **IMMUNITY**; **VACCINATION**.

D.S.T.

SMELL, one of the five special senses (q.v.), by which odors are perceived by man and animals. The nose, equipped with olfactory nerves, is the special organ of smell. The olfactory nerves also account for differing tastes of substances taken into the mouth; that is, most sensations that ap-

pear introspectively as tastes are really smells.

Sensations of smell are difficult to describe and classify, but useful categorizations have been made by noting the chemical elements of odorous substances. Recent studies suggest that the shape of an odor-causing chemical molecule determines the nature of the odor of that molecule or substance. Research has pointed to the existence of seven primary odors corresponding to the seven types of smell receptors in the olfactory-cell hairs, namely: camphorlike, musky, floral, peppermintlike, ethereal (dry-cleaning fluid, for example), pungent (vinegarlike), and putrid. Olfactory research also indicates that substances with similar odors have molecules of similar shape. These molecules are believed to combine with specific cells in the nose or with chemicals within those cells. This process is the first step in a series that continues with the transmission of impulses by the olfactory nerve and ends with the perception of odor by the brain. See NERVOUS SYSTEM: *Anatomy and Function*; NOSE; TASTE.

SMELT, common name for about thirteen species of fish of the genus *Osmerus* in the Osmeridae family, characterized by the presence of a small adipose fin on the dorsal surface of the body, and by rather large scales, which readily fall off. The form is very troutlike but much more slender; the tail is larger in proportion, and more forked. Although rarely exceeding 6 in. in length, the smelt is used extensively as food.

SMELTING. See METALLURGY.

SMETANA, Bedřich (1824–84), Czech composer, born in Litomyšl, Bohemia (now Czechoslovakia), and trained as a pianist by the Bohemian-German music teacher Josef Proksch (1794–1864) in Prague. With the help of the Hungarian composer and pianist Franz Liszt (q.v.), Smetana established a fashionable music school in Prague in 1848. Dissatisfied with life under Austrian domination (see BOHEMIA), he accepted an appointment at Göteborg, Sweden, as conductor of the Philharmonic Society, and held the post from 1856 to 1861. In 1863 Smetana settled permanently in Prague; he opened another music school and became conductor of the choral society Hlahol. In 1866 he was appointed conductor of the newly established Czech opera house in Prague, but resigned in 1874 because of sudden deafness. Despite this handicap he continued to compose, and produced some of his greatest works in the last years of his life.

Smetana was the founder and the greatest composer of the Czech national school. He

fashioned his music, particularly his rich melodic style, on the folk songs and dances of his country, and portrayed Czech national life in such works as his comic opera *The Bartered Bride* (1866) and the cycle of six symphonic poems *My Country* (1874–79; two popular works from this cycle, the *Moldau* and *From the Fields and Groves of Bohemia*, are often performed separately at orchestral concerts. Smetana wrote seven other operas, including *The Brandenburgers in Bohemia* (1866), *Dalibor* (1868), *Two Widows* (1874), *The Kiss* (1876), and *The Secret* (1878); symphonic poems in the style of Liszt, including *Richard III* (1858), and *Hakon Jarl* (1861); a piano trio in G minor (1855); two string quartets in E minor (1876; often called *From My Life*) and C minor (1882); and many piano compositions, songs, and choruses. See FOLK MUSIC: *Hungary and Eastern Europe*; OPERA; PROGRAM MUSIC; SYMPHONY.

SMILAX, genus of about 225 species, in the Lily family, Liliaceae, mostly herbs and woody climbing or trailing plants, best represented in the temperate and tropical parts of Asia and America. In some species, for example, in the greenbriers, the stems are often very prickly. The roots or rootstocks of a number of species yield sarsaparilla. About a dozen American species are found, the best known being *S. herbacea*, carrion flower, with herbaceous stems, and *S. rotundifolia*, the greenbrier or horse brier.

SMITH, Adam (1723–90), British philosopher and economist, born in Kirkcaldy, Scotland, and educated at the universities of Glasgow and Oxford. From 1748 to 1751 he gave lectures on rhetoric and belles-lettres in Edinburgh. During this period a close association developed between Smith and the Scottish philosopher David Hume (q.v.), that lasted until the latter's death in 1776 and contributed much to the development of Smith's ethical and economic theories. Smith was appointed professor of logic in 1751, then professor of moral philosophy in 1752, at the University of Glasgow. He later systematized the ethical teachings he had propounded in his lectures and published them in his first major work, *Theory of Moral Sentiments* (1759). In 1763 he resigned from the university to accept the position of tutor to Henry Scott, 3rd Duke of Buccleuch (1746–1812), whom he accompanied on an eighteen-month tour of France and Switzerland. Smith met and associated with many of the leading Continental philosophers of the physiocratic school which based its political and economic doctrines on the supremacy of natural law, wealth, and order; see ECONOMICS: *History*. He was particularly influenced by the

A N
I N Q U I R Y
I N T O T H E
Nature and Causes
O F T H E
W E A L T H O F N A T I O N S.

By ADAM SMITH, LL.D. and F.R.S.
Formerly Professor of Moral Philosophy in the University of GLASGOW.

I N T W O V O L U M E S.
V O L. I.

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The title page for the original edition (1776) of The Wealth of Nations by Adam Smith.

French philosophers François Quesnay and Anne Robert Jacques Turgot (qq.v.), whose theories Smith later adapted in part to form a basis for his own. From 1766 to 1776 he lived in Kirkcaldy, preparing his celebrated treatise on political economy, *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776). Smith was appointed commissioner of customs in Edinburgh in 1778; he served in this capacity until his death. In 1787 he was also named lord rector of the University of Glasgow.

The Wealth of Nations. The work represents the first serious attempt in the history of economic thought to divorce the study of political economy from the related fields of political science, ethics, and jurisprudence (qq.v.). It embodies a penetrating analysis of the processes whereby economic wealth is produced and distributed, and demonstrates that the fundamental sources of all income, that is, the basic forms in which wealth is distributed, are rent, wages, and profits. Smith proceeds to a profound study of the historical development of industry and commerce among the European nations, and of the nature of capital. The central thesis of the work is that capital is best employed for the production and distribution of wealth under conditions of governmental noninterference, or *laissez faire*, and free trade (q.v.). In Smith's

view, the production and exchange of goods can be stimulated, and a consequent rise in the general standard of living attained, only through the efficient operations of private industrial and commercial entrepreneurs acting with a minimum of regulation and control by governments. To explain this concept of government maintaining a *laissez faire* attitude toward commercial endeavors, Smith proclaimed the principle of the "Invisible Hand"; every individual in pursuing his own good was led, as if by an invisible hand, to achieve the best good for all. Therefore any interference with free competition by government was almost certain to be injurious. Although this view has undergone considerable modification by economists in the light of historical developments since Smith's time, many sections of *The Wealth of Nations*, notably those relating to the sources of income and the nature of capital, have continued to form the basis for theoretical study in the field of political economy. *The Wealth of Nations* has also served, perhaps more than any other single work in its field, as a guide to the formulation of governmental economic policies. See also INDIVIDUALISM.

SMITH, Alfred Emanuel (1873–1944), American political leader, born in New York City. He had little formal education, and engaged in various occupations before being appointed a clerk in the office of the commissioner of jurors in New York City in 1895. Eight years later he was elected as a Democratic Party member to the New York State Assembly, to which he was re-elected for a series of successive terms until 1915; in 1911 he was the majority leader, in the following year the minority leader, and in 1913 he became the speaker of the assembly. Smith was elected sheriff of New York County in 1915 and president of the New York City Board of Aldermen in 1917, and then served four terms as governor of New York State (1919–21; 1923–25; 1925–27; and 1927–29). As governor, Smith was an advocate of social-reform policies. Among the measures that made his administrations notable were large appropriations for the care of the insane; equalization of the salaries of men and women in public-school teaching; establishment of a 48-hr. work week in industry for women and minors (see HOURS OF LABOR); ratification of the Nineteenth Amendment to the United States Constitution (q.v.), providing for woman suffrage (q.v.); and reform of the administrative apparatus of the State, including the institution of an executive budget.

Smith was an unsuccessful candidate for the Democratic Party nomination for the Presidency



Alfred E. Smith

UPI

in 1920 and 1924. He sought the nomination again in 1928 and was chosen on the first ballot. In the election he was badly defeated by the Republican nominee Herbert Clark Hoover (q.v.), winning the electoral vote of only eight States. Political analysts attributed his unexpectedly poor showing to three principal causes: his association with the Tammany Society (q.v.); his opposition to prohibition (q.v.); and, above all, his Roman Catholic faith.

In 1929 Smith was succeeded as governor of New York by Franklin Delano Roosevelt (q.v.), later President of the United States, and entered private business. With a group of associates in the banking business, he planned and carried through the construction in New York City of the Empire State Building, until 1970 the tallest skyscraper in the world; see *AMERICAN ARCHITECTURE: Modern American Architecture: Technology and the Tall Buildings*. He continued to be influential in the Democratic Party until 1936,

when he opposed the nomination of President Roosevelt for reelection. Smith's autobiography, *Up to Now*, was published in 1929.

SMITH, Bessie. See *Jazz: Early Jazz: Chicago Jazz*.

SMITH, David (1906–65), American sculptor, born in Decatur, Ind. He studied at the Art Students League in New York City, from 1927 to 1932, and later traveled and studied in Europe. On his return to the United States in 1936 he began to produce experimental works in welded wrought iron and steel. These abstract sculptures, at once intricate and massive, often include familiar manufactured objects or miscellaneous fragments of objects. The first exhibition of Smith's work was held in New York City in 1937, and his sculpture was included in the 1958 Biennale exhibit in Venice, Italy. Examples of his work are "Cockfight" (1945, Whitney Museum of American Art, New York City) and "History of Leroy Borton" (1956, Museum of Modern Art, New York City).

SMITH, Donald Alexander, 1st Baron Strathcona and Mount Royal (1820–1914), Canadian administrator, born in Scotland. He entered the service of the Hudson's Bay Company (q.v.) in 1838. He was appointed special commissioner during the first Riel rebellion (see *RIEL, LOUIS DAVID*) of 1869–70, and he was elected a member of the Dominion House of Commons in 1871, serving for many years. He became a controlling member of two railroad companies, the Great Northern R. in 1879, and the Canadian Pacific R. in 1885. In 1889 Smith was made the governor of Hudson's Bay Company, and in 1896, Canadian high commissioner in Great Britain. He was created a baron in 1897.

SMITH, Edmund Kirby. See *KIRBY-SMITH, EDMUND*.

SMITH, Howard K(ingsbury) (1914–), American radio and television news analyst, correspondent, and author, born in Ferriday, La. He received his B.A. degree from Tulane University in 1936, traveled briefly in Germany as an observer of National Socialism (q.v.), and then for a time reviewed foreign affairs for the New Orleans *Item-Tribune*. In 1937 he returned to Europe as a Rhodes scholar, taking advantage of long school vacations during the next two years to visit the Soviet Union, Austria, Germany, and the Netherlands. He was a United Press correspondent in London when World War II began.

In 1940 Smith, who spoke German, was sent to Berlin. He remained there, first as a United Press reporter, later as a radio correspondent for the Columbia Broadcasting System (C.B.S.), until he was expelled for his anti-National Socialist

views late in 1941. Smith's book, *Last Train from Berlin* (1942), records his observations in Germany. He was assigned by C.B.S. in 1944 to report on the operations of the U.S. Ninth Army during its sweep through France, the Netherlands, and Germany. In 1945 he represented C.B.S. at the war-crimes trials (q.v.) in Nuremberg. He then held a variety of C.B.S. assignments in Europe and the U.S. His script for the C.B.S. documentary *The Population Explosion* (1960), written in collaboration with the American television producer Avram Westin (1929–), won several awards, including one from the Television Academy of Arts and Sciences.

In 1962 Smith joined the American Broadcasting Company (A.B.C.) as a television news analyst in Washington, D.C.

SMITH, Ian Douglas. See RHODESIA: *History*.

SMITH, Jedediah Strong (1798–1831), American fur-trapper and explorer, born in Bainbridge, N.Y. He became a fur trapper in the West as a young man and in the last six years of his life earned a place as one of the greatest pathfinders in American history. In 1826 he ventured southwest with a party of seventeen from Great Salt Lake in search of trade routes, for fur-trapping rights, to California and the Northwest. After crossing the Mojave Desert, he reached Mission San Gabriel, Calif., near present-day San Diego, probably the first white man to reach California from the east. Sent away by the Spanish governor, who was suspicious of Smith, he proceeded north, becoming the first American to cross the Sierra Nevada Mts. and, proceeding northeast across present-day Nevada, became the first white man to cross the Great Salt Lake Desert. In returning to California the following year, ten of his men were killed by Indians, and in 1828 Indians slew most of his party on an expedition to Fort Vancouver (now Vancouver, Wash.). Smith was later killed by Comanche Indians on the Santa Fe Trail.

SMITH, John (1579?–1631), English colonizer in America, born in Willoughby, Lincolnshire. After some years of military adventure abroad, he became an investor in the London Company (q.v.), and he was one of the members of the expedition that, in 1607, established Jamestown (q.v.), Va., the first permanent English settlement in America. He organized trade with the Indians and led expeditions to explore and map the region surrounding Jamestown. On one of these expeditions he was captured by the Indian chief Powhatan and, according to his own account, was saved from being put to death by the chief's daughter Pocahontas (qq.v.).

Smith was president of Jamestown colony

from 1608 to 1609, when he returned to England after being badly burned in an accident. His courageous and resourceful leadership is credited with largely having carried the colony through its first two years. In 1614 he returned to America and led an expedition that explored and mapped the coast of New England, from which he brought valuable furs and fish back to England. Smith's writings include *The Generall Historie of Virginia, New-England, and the Summer Isles* (1624) and *The True Travels, Adventures, and Observations of Captaine John Smith* (1630).

SMITH, Joseph (1805–44), American founder of the Mormon Church (see MORMONS), born in Sharon, Vt. At the age of ten he moved with his parents to Palmyra, N.Y. There, in 1820, according to his own testimony, he had the first of a series of visions through which he learned that the church of Christ had been withdrawn from the world and that he had been given a divine commission to restore it. In 1827 Smith said that he had obtained from an angel of the Lord a volume written on golden plates in a strange pictographic script, setting forth the history of the true church of Christ in the United States and revealing a relationship between the ancient Hebrews (see JEWS) and the pre-Columbian American Indians. Smith dictated a translation of this work and published it in 1830 as *The Book of Mormon*, otherwise known as the *Golden Bible*. On April 6 of the same year he organized, at Fayette, N.Y., the Church of Jesus Christ of Latter-day Saints. The new faith rapidly obtained adherents, and in 1831 Smith established his congregation at Kirtland (now Kirtland Hills), Ohio, moving then to Independence, Mo., and somewhat later to Commerce, Ill., which the Mormons restyled Nauvoo, the town's present name. In subsequent visions, according to Smith, he received the injunctions embodied in *A Book of Commandments* (1833), *Doctrine and Covenants* (1838), and *Pearl of Great Price* (1842), which with *The Book of Mormon*, expound the polity and doctrinal tenets of the Mormon Church.

In 1843, as a result of what he termed a revelation, he authorized the practice of polygamous marriage (see POLYGAMY) for the Mormon community; he himself is believed to have taken many wives. This pronouncement brought about the first serious schism in the Church of the Latter-Day Saints. A number of dissident Mormons established a newspaper, the *Nauvoo Expositor*, to combat the spread of polygamy. In the first and only number of the *Expositor*, polygamy was denounced and a call was issued for

thoroughgoing reform in the government of the Mormon community. Smith promptly suppressed the paper, destroyed the press on which it was printed, and burned the printing office. The owners and publishers of the *Expositor* thereupon obtained a writ for the arrest of Smith and the Nauvoo Mormon council; the case was heard, however, by a Mormon justice of the peace, who summarily dismissed it. Smith did not escape, for the hostility of the non-Mormon inhabitants of the neighboring towns and villages led to his imprisonment, together with his brother, Hyrum Smith (d. 1844), at Carthage, Ill., on the vague charge of riot. An angry mob easily overpowered the apathetic guards, dragged Joseph and Hyrum from the jail, and shot them to death.

SMITH, Margaret Chase (1897–), United States Senator, born in Skowhegan, Me. After being graduated from high school in Skowhegan, she taught school for one year before going into business. She was circulation manager for the weekly *Independent Reporter* in Skowhegan from 1919 to 1928, and from 1928 to 1930, while with a woolen goods firm, acted as treasurer of the New England Waste Process Co. in Skowhegan. She served on the Republican State Committee of Maine from 1930 to 1936. In 1940 she was elected to the United States Congress, an office that had been won by her husband, Clyde Harold Smith (1876–1940), three years before.

She represented Maine as a congresswoman until 1948, when she was elected to the United States Senate, thus becoming the first woman to be elected to both houses of Congress. She was reelected to the Senate in 1954, 1960, and 1966. In 1972, however, she was defeated in her bid for a fifth term by the Democratic Party candidate, Representative William Dodd Hathaway (1924–). An independent, she spoke out against extremists of both left and right.

In 1964 Senator Smith was a Presidential nominee at the Republican National Convention, the first woman to be so honored by a major political party.

SMITH, Samuel Francis (1808–95), American Baptist clergyman and poet, born in Boston, Mass., and educated at Harvard College University and Andover Theological Seminary. He was still a seminarian when he wrote his well-known missionary hymn "The Morning Light Is Breaking".

Holding pastorates in Maine (1833–42) and Massachusetts (1842–54), he also served as professor of modern languages at Waterville (now

Colby) College (1833–42) and editor of a Boston periodical, the *Christian Review* (1842–48). From 1854 to his death, he was editorial secretary of the American Baptist Missionary Union. His most famous composition is the patriotic hymn "America" (1832), popularly known as "My Country 'Tis of Thee", set to the melody of the British national anthem; see AMERICA. A collection of his verse was published under the title *Poems of Home and Country* (1895).

SMITH, Sydney (1771–1845), British writer and Anglican clergyman, born in Woodford (now part of Wanstead and Woodford municipal borough), Essex, England, and educated at the University of Oxford. He became a curate in a Wiltshire parish in 1796 and in 1798 went to Edinburgh, where he helped to found the literary journal, the *Edinburgh Review*. From 1804 to 1806 he gained a reputation in London as a preacher, lecturer on moral philosophy, and wit. He served as a village parson in Yorkshire (1809–28) and as a prebend in Bristol Cathedral (1828–31).

In 1831 Smith was appointed canon residentiary of Saint Paul's Cathedral, London, where he remained until his death. Smith's writings include *Peter Plymley's Letters* (1807–08), written to protest restrictions against Roman Catholics (see CATHOLIC EMANCIPATION ACT), and sixty-five articles, printed between 1802 and 1827 in the *Edinburgh Review*, that were collected and republished in 1839.

SMITH, Theobald (1859–1934), American pathologist, born in Albany, N.Y., and educated at Cornell University and Albany Medical College. He was director of the pathological laboratory in the Bureau of Animal Industry of the United States Department of Agriculture from 1884 to 1895. From 1886 to 1895 he served also as professor of bacteriology at Columbian University (now George Washington University). During the next twenty years, until 1915, he was director of the pathological laboratory of the Massachusetts Board of Health and professor of comparative pathology at Harvard University. Thereafter until 1929 he was director of the department of animal pathology at the Rockefeller Institute for Medical Research (now the Rockefeller University) in New York City.

Smith is best known for his investigations of the etiology and transmission of infectious and parasitic diseases. In 1893 he identified the protozoan that is the causative organism of Texas fever (q.v.) and demonstrated that the organism is transmitted by a cattle tick. In 1898 he discovered that tuberculosis (q.v.) in human beings and in cattle is caused by different bacilli. Smith

SMITH, WALTER BEDELL

was also one of the first to demonstrate the immunizing effects of neutral toxin-antitoxin sera in the prevention of diphtheria (q.v.). In 1934 he was elected president of the Rockefeller Institute for Medical Research. His works include *Studies in Vaccinal Immunity* (1923) and *Parasitism and Disease* (1934).

SMITH, Walter Bedell (1895–1961), American army officer and diplomat, born in Indianapolis, Ind. He entered the United States Army in 1917, serving as an infantry officer in France during World War I, and remained in the service following the war. After the outbreak of World War II he served at first in Washington with the combined chiefs of staff, but received his most important post when, as a brigadier general, he was named chief of staff of Supreme Allied Commander Dwight David Eisenhower (q.v.). As Eisenhower's chief aide (1942–45), he played a central role in formulating strategy for the major African, Mediterranean, and European campaigns of the war. Smith headed the Allied delegation at the formal surrender of Germany at Reims, France, in 1945.

After the war, Smith was U.S. ambassador to the Soviet Union from 1946 to 1949, when he was named commander of the First Army. From 1950 to 1953 he was director of the Central Intelligence Agency and in 1953–54 undersecretary of state. Upon his retirement in the latter year he went into private business. He is the author of *Eisenhower's Six Great Decisions: Europe, 1944–45* (1956), first published in magazine form in 1946, and *My Three Years in Moscow* (1950).

SMITH, William (1769–1839), British geologist, born in Churchill, Oxfordshire, England. As a young engineer and surveyor he began geological investigations of English rock strata; as a result of these studies Smith became known as the father of English geology. In 1815 he completed his most famous work, the *Geological Map of England and Wales, With Part of Scotland*, and between 1819 and 1822 he published twenty-one colored maps, representing twenty-one English and Welsh counties and known collectively as a *Geological Atlas of England and Wales*. These were the first geological maps in which an attempt was made to represent the distribution and location of the rock formations of an entire country. Smith also was the first to characterize rock strata by their respective fossil inclusions, a method of classification described in his *Strata Identified by Organized Fossils*, published between 1816 and 1819; see GEOLOGY, HISTORICAL. In 1831 Smith became the first recipient of the Wollaston medal of the Geological Society of London.

SMITH COLLEGE, privately controlled non-sectarian institution of higher education for women, situated in Northampton, Mass. The college was founded in 1871 with an endowment bequeathed by the American philanthropist Sophia Smith (1796–1870) to give women an opportunity for education equal to that afforded in colleges for men; the institution was opened for instruction in 1875. Under its first president, the American educator Laureus Clark Seelye (1837–1924), it became one of the leading women's colleges in America, and it has since maintained its high academic standards. For many years the college offered students a system of elective courses that permitted a wide selection of subjects; however, a new curriculum instituted in 1947 greatly increased the number of required subjects. Students may study abroad during the junior year. Courses leading to the degrees of bachelor, master, and doctor are offered in the liberal arts; in addition, the degree of master is conferred in physical education, social work, education, teaching, and teaching of the deaf, and the degree of doctor in social work. In 1968 the Smith College library contained 500,000 bound volumes. The Smith College Museum of Art, founded in 1881, specializes in painting of the past 200 years. In 1975 enrollment at the college totaled 2659 and the faculty numbered 450.

SMITHSON, James (1765–1829), British mineralogist and chemist, born in France, and educated at the University of Oxford. The natural son of Sir Hugh Percy, originally Sir Hugh Smithson (1715–86), and later also 1st duke of Northumberland, he used the name Macie, from his mother, Elizabeth Keate Macie, until 1800. As James Lewis or Louis Macie, he became a fellow of the Royal Society in 1787. He read twenty-eight papers on scientific subjects before the Royal Society and published eighteen in *Annals of Philosophy*. Smithson spent much of his life on the Continent and died in Genoa, Italy. In his will Smithson bequeathed his estate to his nephew and then, if the nephew should die without heir, to the United States government for the foundation of the Smithsonian Institution (q.v.) in Washington, D.C. The institution was founded in 1846 by act of Congress and in 1904 Smithson's remains were reinterred there. The Smithsonian Institution published the complete scientific writings of James Smithson in 1879–80.

SMITHSONIAN INSTITUTION, independent agency of the United States government, headquartered in Washington, D.C. A center for basic scientific research, it is also the largest mu-

seum-gallery complex in the world. It was founded in 1846 by act of Congress under the terms of the bequest of the British chemist and mineralogist James Smithson (q.v.) for "an establishment for the increase and diffusion of knowledge among men". To accomplish these objectives, the institution maintains collections of scientific and artistic interest, sponsors scientific research and exploration, publishes books and periodicals, and provides for the international exchange of publications. Most of the units, or bureaus, of the institution are located in Washington, D.C.

The Smithsonian Institution is governed by a board of regents, which consists of the Vice-President of the United States, the chief justice, three members each of the United States Senate and House of Representatives, and nine citizens of the U.S. appointed by joint resolution of Congress. The secretary of the institution acts as executive director.

The library of the Smithsonian Institution, including the Smithsonian deposit in the Library of Congress (q.v.), contains almost 2,000,000 volumes. These are primarily scientific publications and the transactions of scholarly organizations.

Among the units of the Smithsonian Institution are the following:

Chesapeake Bay Center for Environmental Studies. Located on Chesapeake Bay near Annapolis, Md., the center maintains wide-ranging research programs on the environment of the area, especially the ecosystem of the Rhode R.

Cooper-Hewitt Museum of Decorative Arts and Design. The museum, administered from 1897 to 1968 by the Cooper Union for the Advancement of Science and Art (q.v.), includes more than 100,000 decorative art items, representing numerous cultures from ancient times to the present; about 30,000 drawings, including many by Winslow Homer (q.v.); and a library of some 25,000 volumes. It is housed in the Carnegie Mansion in New York City.

Freer Gallery of Art. The gallery, a center for research in Oriental art, was established through a gift of the American art collector Charles Lang Freer (1856-1919). The Freer Gallery is also noted for a collection of paintings by the American painter James McNeill Whistler (q.v.).

Hirshhorn Museum and Sculpture Garden. Housed in a striking circular structure (opened 1974) designed by the American architect Gordon Bunshaft (1909-), the museum contains notable paintings and sculptures by 19th- and 20th-century European and American artists. The sculpture garden displays works by Henri Matisse, Henry Moore, Auguste Rodin (qq.v.),

and other masters of modern sculpture. The collection was donated by the American financier Joseph H. Hirshhorn (1899-).

John F. Kennedy Center for the Performing Arts. Located on the banks of the Potomac R., the center is administered by a separate board of trustees. It was established as a memorial to President John Fitzgerald Kennedy (q.v.) and consists of a cultural center devoted to musical and dramatic performances and to the development of artistic programs in which persons of all ages may participate.

National Air and Space Museum. A comprehensive survey of the development of aviation and astronautics is presented in this museum, which includes the *Spirit of St. Louis*, the plane flown by the American aviator Charles A. Lindbergh (q.v.) in the first nonstop solo flight across the Atlantic Ocean.

National Collection of Fine Arts. A bureau distinct from the National Gallery of Art, the National Collection of Fine Arts exhibits works of American art in the Old Patent Office Building, which it shares with the National Portrait Gallery. The latter displays portraits of persons who have made significant contributions to the development of the U.S.

National Gallery of Art. Although it is an integral part of the Smithsonian Institution, the National Gallery of Art is administered by a separate board of trustees. Established in 1937 to exhibit the significant art collection of the American financier and statesman Andrew William Mellon (q.v.), the gallery subsequently acquired several other distinguished collections. Among many masterpieces in the National Gallery of Art is the painting "Ginevra de'Benci" by the Italian painter Leonardo da Vinci (q.v.).

National Museum of History and Technology. The exhibits in the museum trace many phases of the development of the U.S., including politics, religion, industry, and agriculture. It contains the original Star-Spangled Banner—the flag that inspired Francis Scott Key (q.v.) to write the national anthem—and the National Postage Stamp Collection.

National Museum of Natural History and National Museum of Man. The museum maintains reference collections and exhibits, including displays of the various stages of plant, animal, and human life and some of the largest dinosaur skeletons ever discovered. Among the exhibits of minerals are many of the world's most famous gems, including the Hope Diamond, the largest blue diamond known.

National Zoological Park. Comprising a collection of more than 2000 living animals, the Na-

SMOG

tional Zoological Park studies animal behavior. **Radiation Biology Laboratory.** The laboratory studies the effects of radiation, especially sunlight, on plant and animal life.

Renwick Gallery. Administered as part of the National Collection of Fine Arts but housed in a separate building, the gallery displays American crafts, decorative arts, and design.

Smithsonian Astrophysical Observatory. Headquartered in Cambridge, Mass., the observatory conducts research in the major areas of astronomy.

Smithsonian Tropical Research Institute. Research in tropical biology is the principal activity of the institute's facilities on Barro Colorado Island, a tropical forest preserve in Gatun Lake, Panama Canal Zone.

Other Divisions. Other units of the Smithsonian Institution include the Anacostia Neighborhood Museum, the Archives of American Art, the Center for the Study of Man, the Smithsonian Institution Traveling Exhibition Service, and the Smithsonian Science Information Exchange, Inc.

SMOG, mixture of solid and liquid fog and smoke particles formed when humidity (q.v.) is high and the air so calm that smoke and fumes accumulate near their source; see FOG; SMOKE. Smog reduces natural visibility and often produces irritation to the eyes and respiratory tract. In dense urban areas, the death rate usually goes up considerably during prolonged periods of smog, particularly when a process of heat inversion creates a smog-trapping ceiling over a city. Smog occurs most often in and near coastal cities, and is an especially severe problem in Los Angeles, Calif., and Tokyo, Japan.

Prevention of smog calls for control of smoke from furnaces, reduction of fumes from metalworking and other industrial plants, and control of noxious emissions from automobiles, trucks, and incinerators. In the United States internal-combustion engines are regarded as the largest contributors to the smog problem, emitting large amounts of contaminants including unburned hydrocarbons and oxides of nitrogen. The number of undesirable components in smog, however, is considerable, and the proportions highly variable. They include ozone, sulfur dioxide, hydrogen cyanide, and hydrocarbons and their products formed by partial oxidation. Fuel obtained from fractionation of coal and petroleum (qq.v.) produces sulfur dioxide, which is oxidized by atmospheric oxygen, forming sulfur trioxide (SO_3). Sulfur trioxide is in turn hydrated by the water vapor in the atmosphere to form sulfuric acid (H_2SO_4).

The so-called photochemical smog, which irritates the eyes and other sensitive membranes and damages plants, is formed when nitrogen oxides in the atmosphere undergo reactions with the hydrocarbons energized by ultraviolet and other radiations from the sun; see ULTRAVIOLET RADIATION. See also AIR POLLUTION.

SMOKE, liquid or solid particles of small size, suspended in air. These particles are usually less than one micron, or one millionth of a meter, in size, so small as not to be individually visible. Larger particles that can be seen singly are generally called dust (q.v.); dust settles relatively rapidly compared to smoke particles. Smoke from burning substances, such as tobacco, wood, or coal, is of familiar occurrence. Smoke from furnaces and industrial plants is frequently a nuisance and hazard that prompts community complaint and control. See AIR POLLUTION; SMOG.

SMOKELESS POWDER. See EXPLOSIVES: *Propellants*.

SMOKING. See CANCER: *Cancer Research: Smoking and Cancer*; NICOTINE; TOBACCO.

SMOLLETT, Tobias George (1721–71), British novelist, born in Dalquhurn, Dumbarton Co., Scotland, and educated at the University of Glasgow. After five years as apprentice to a surgeon in Glasgow, he became a surgeon's mate on a British naval vessel and in 1744 began practice as a surgeon in London. His career as a writer began with a historical play and some political satires, but it was his first attempt at a picturesque novel (q.v.), *Roderick Random* (1748), that made him famous. It was followed by several other novels in which colorful adventures are mixed with grotesque characterizations and broad satire. *The Adventures of Peregrine Pickle* (1751) and *Ferdinand Count Fathom* (1753) were so successful that Smollett abandoned practice of surgery. His best novel, *The Expedition of Humphry Clinker* (1771), written in Italy during the last two years of his life, has become a classic. His other books include *The Adventures of Sir Launcelot Greaves* (1762), *Travels in France and Italy* (1766), and *The History and Adventures of an Atom* (1769), a coarse satire on English public affairs.

SMUGGLING, act of bringing on shore or carrying from shore goods for which the duty has not been paid or goods the importation or exportation of which is prohibited; see CUSTOMS DUTIES. The most frequent examples of smuggling involve individuals who fail to declare to the customs officials merchandise on which an import duty is levied. Other and more serious instances of smuggling are those involving illicit

traffic in narcotic drugs, such as opium and heroin; see NARCOTICS. In the United States during the period of Prohibition (q.v.) the smuggling of liquor assumed serious proportions. By Federal law, a person convicted of smuggling may be fined an amount not exceeding \$5000, or imprisoned for a time not exceeding two years, or both. As an additional or alternative penalty at the discretion of the Collector of Customs, concealment of dutiable articles in baggage is punishable by the forfeiture of such articles, and the persons guilty may be liable to pay treble the value of the concealed articles. In some cases the smuggled property is condemned and sold, and the proceeds, after payment of costs and rewards for information, if any, are paid into the United States Treasury.

SMUT, or **BUNT**, popular name of certain small fungi, belonging to the order Ustilaginales, which infest flowering land plants, especially the grasses. The name is derived from the appearance of the spores, which are nearly black. See FUNGI.

SMUTS, Jan Christiaan (1870–1950), South African soldier and statesman, born near Riebeeck West, Cape Colony (now Cape of Good Hope Province, Republic of South Africa), and educated at Victoria College (now the University of Stellenbosch) and at the University of Cambridge, England. He began to practice law in Cape Town in 1895, and in the same year entered political life in support of the imperialist policies of the British statesman and governor of Cape Colony, Cecil Rhodes (q.v.). In the South African War (q.v.), however, Smuts fought with the Boers (q.v.) against the British and later became the commander of the Boer commando (q.v.) forces. In 1902 he was a signatory of the Treaty of Vereeniging, that resulted in the establishment of the former Boer republics of the Transvaal and Orange Free State (qq.v.) as self-governing colonies of the British crown.

In 1906 Smuts became the colonial secretary in the cabinet of the first Transvaal prime minister, Louis Botha (q.v.). After the establishment of the Union of South Africa (now the Republic of South Africa) as a British dominion in 1910, Smuts was appointed to several ministerial posts in the new government. In 1910 he and Botha founded the South African Nationalist Party, which followed a moderate policy, later opposing organizations such as the Afrikaner Nationalist Party, that advocated complete independence for the Boers. Following the outbreak of World War I (q.v.), Smuts took part in the suppression of a pro-German Boer revolt in 1915. In the following year he was appointed com-

mander in chief of the British imperial forces in East Africa, where he won a number of notable victories over the German colonial troops. In 1917 and 1918 he was a representative of the Union of South Africa in the imperial war cabinet in Great Britain. After the war, in 1918, he wrote a memorandum entitled *The League of Nations: A Practical Suggestion*, a substantial portion of which was incorporated into the covenant of the League of Nations (q.v.). With Botha, Smuts represented South Africa at the peace conference in Versailles; see VERSAILLES, TREATY OF.

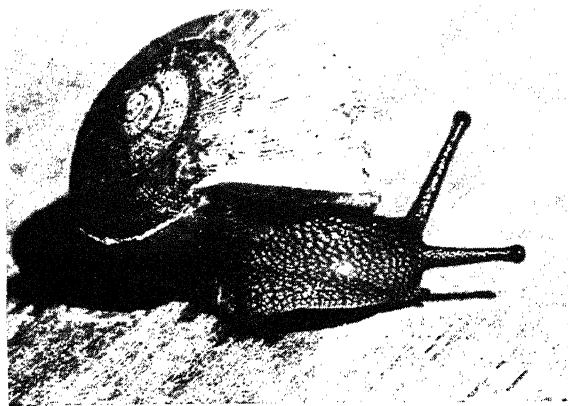
Smuts became prime minister of the Union of South Africa in 1919. His suppression of a miners' strike in 1922 antagonized labor, which then joined forces with other opposition elements against Smuts. He resigned from the government in 1924, and his party was defeated in the election of that year. In 1933 he was appointed deputy prime minister in the government of the South African political leader James Barry Munnik Hertzog (q.v.), serving in that post until 1939, when he again became prime minister. During World War II (q.v.) he was also commander in chief of the South African armed forces. Smuts resigned from the government after his defeat in the election of 1948, but was subsequently reelected to the parliament of the Union, in which he led the opposition to the government of Prime Minister Daniel François Malan (q.v.).

Smuts is the author of *Holism and Evolution* (1926), a philosophic treatise on the nature of the world, which had a wide influence on philosophic thought in Europe.

SMYRNA, town of Georgia, in Cobb Co., about 10 miles N.W. of Atlanta. Located in a cotton and lumber region, furniture and fertilizers are manufactured. Dobbins Air Force Base is nearby. Pop. (1960) 10,157; (1970) 19,157.

SMYRNA. See İZMİR.

SNAIL, name applied to many gastropod mollusks, and especially to the terrestrial air-breathing gastropods, Pulmonata or Helicidae, and to the fresh-water gastropods, such as the pond snail, *Physa*; see GASTROPODA. The Pulmonata are gastropods with two pairs of tentacles, fitted to breathe air through a pallial cavity formed by the union of the front edge of the mantle with the neck region. The spiral shell is either well developed or, in the slugs, vestigial or absent. The eyes are either at the base of the tentacles or situated at the end of the larger pair. Snails are mostly plant eaters or live on dead leaves, cutting their food by means of the long slender rasplike radula or "lingual ribbon". After passing



Land snail emerging from its shell.

Leonard Lee Rue –
National Audubon Society

through the cleavage, gastrula, trochophore, and veliger stages, the snail assumes definite molluscan characteristics; see MOLLUSCA.

In many parts of Europe snails are a popular delicacy, and snail gardens, *escargotières*, are common in France and other countries. When snails are eaten directly after being collected, they may, from having fed on some poisonous matters, prove harmful. The snails should be fed in special gardens and should be cooked before being eaten.

In some places snails may damage or destroy vegetable crops; and, in tropical regions, certain species of snails act as alternate hosts to organisms that can cause various human diseases, such as schistosomiasis (q.v.).

SNAKE, common name for any reptile (q.v.) belonging to the suborder Serpentes. The body is greatly elongated and most often cylindrical, but the sea snakes and many tree-dwelling snakes have the body compressed laterally. Snakes lack external limbs, although a few still retain tiny remnants of hind legs, the tips of which are visible in large boas and pythons at the base of the tail. The body is covered with scales of a horny epidermal material arranged in regular rows and usually overlapping, like tiles on a roof. The scales on the back and sides are characteristically smaller than those on the top of the head and along the ventral surface. The scales on the dorsal surface may be smooth or bear a long raised ridge or keel; other scale modifications may include small knobs and tiny pits. The skin and outer covering of the horny scales are shed periodically and usually in one piece, including the hard, transparent covering of the eye known as the spectacle; snakes lack movable eyelids and the spectacle protects the constantly open eyes. The frequency of shedding varies with different species and within a species, according to the size and age of the individual. Young, rapidly growing snakes shed their skins more frequently than the slow-grow-

ing adults. In some species the skin is shed approximately every twenty days; in others it is shed but once a year.

Locomotion. One surprising characteristic of snakes is their ability to move rapidly without legs. Four quite different types of locomotion are used by snakes in getting from place to place. The most frequently used method is the simple, undulating crawl, which appropriately is called the serpentine method. In this type of locomotion, the snake pushes against the ground on the back side of each curve or undulation and flows smoothly forward. In another method called caterpillar, used only by the heavier-bodied snakes, the skin of the ventral surface is moved forward and backward by strong muscles, and the broad belly scales grip the ground, moving the snake forward in a straight line. This method has given rise to the erroneous statement that snakes "walk on their ribs", but actually the ribs do not move forward and backward in any of the four types of movement. Several desert-dwelling species use a special type of locomotion, called sidewinding to move on loose sand. In this method the snake rolls its body along sidewise in a looping motion. The fourth method is known as concertina, because the body is alternately stretched out and pulled together as the snake moves from one anchor point to another. The concertina is used in crossing smooth surfaces and in climbing. The most common of the four, and the one that enables all snakes to achieve maximum speed, is the serpentine method. Not all snakes can use each of the other methods. The fastest speed any snake can attain is about 8 m.p.h., slower than a man can run, but few can go that fast. In climbing, any of the methods except sidewinding may be used, but snakes swim only by means of the serpentine method. Some species of colubrid snakes in eastern Asia and New Guinea are reported to fly. These snakes do not actually fly, but they may drop or hurl themselves from fairly high trees and fall or even partly glide to the ground without injury.

Structure and Function. The long, slender body of the snake contains a large number of vertebrae, never less than 100 and sometimes more than 300, each with a pair of ribs except the first two, which connect with the head. The skeleton is light in structure and is modified to provide great freedom of movement. The skull in particular is loosely built and can be stretched in several directions, permitting the snake to swallow very large meals in relation to the size of the head and body. This mobility can be seen especially in the two bones of the lower

jaw, which are attached to the skull by a short, movable bone and which are united at the front end merely by an elastic ligament. Both jaws have a large number of sharp, needlelike teeth, all curved toward the rear of the mouth. The teeth are arranged in six rows paralleling the long axis of the head, that is, two rows on each side of the upper jaw and one on each side of the lower jaw. Except in the venomous species, the teeth are solid and are replaced periodically. When the snake catches its prey, the recurved teeth enable it to retain a firm hold. The food is killed quickly and swallowed by alternate movement of the rows of teeth, which work to pull the food into the mouth. As the food passes through the mouth, it is covered with saliva; contrary to popular opinion, snakes do not cover their food with saliva before taking it into the mouth. Most meals are swallowed easily and quickly, but a truly large meal may require several hours. The big pythons can consume animals up to about 150 lb. in weight, but swallowing such a meal is a laborious process.

Venomous snakes have two hollow, hypodermiclike teeth, known as the fangs, in the front of the upper jaw. Like the other teeth, they are replaced periodically and the new fang moves into place before the old one is lost. Thus, for a short time, there may be two fangs on each side of the jaw. In the solenoglyphs, a large group of snakes including the rattlesnakes and vipers, the fang-bearing bone is attached to the skull in such a manner that the fangs can be moved back up against the roof of the mouth when not in use. The cobras and coral snakes represent another large group of snakes, the proteroglyphs, in which the fangs are not movable, but are constantly erect. The fangs are connected by means of the venom duct to the two venom glands, which are modified salivary glands situated on each side of the head behind the eye. The snake must bite to inject its venom; no snake has a stinger in its tail. Snakes can bite at any time and from any position, including underwater. They normally strike out from a defensive coil, projecting the head and anterior body at the victim. As soon as the head leaves the coil the mouth is wide open. The solenoglyphs stab the erect fangs into the target and usually withdraw them immediately, either with or without a biting movement. The proteroglyphs usually bite, and the bite may be retained for several seconds. An interesting modification found in only three species of snakes enables them to spit or eject the venom in a fine spray, which is aimed at the eyes of an enemy and projected for distances up to 8 ft. If the venom

gets into the eyes, it may cause blindness. The spitting is used only in defense and never to get food.

Venom. The venom is a complex mixture of proteins that destroy various tissues of the body, immobilizing or killing the prey. Venoms frequently are classified in two major categories, neurotoxic, or nerve-affecting, and hemotoxic, or blood-affecting. Actually all venoms contain elements of both types, but one type usually predominates. In general, the neurotoxic type is more serious or more effective, usually acting on the central nervous system to produce respiratory failure or suppression of the heart action. Hemotoxins destroy blood cells, the lining of the blood vessels, and other tissue. Because of the local destruction of circulatory cells, the hemotoxic venom spreads more slowly and has a slower action than the neurotoxins.

Behavior. Snakes have a well-developed nervous system and an intelligence intermediate between that of fish and mammals. They show a marked adaptability to captivity and many become quite tame. The members of many species are nervous and excitable when first caught, but usually respond quickly to gentle care. When disturbed in the wild a number of kinds go through elaborate bluffing performances and numerous harmless forms appear more dangerous than venomous ones. Although snakes lack a true voice, they often hiss loudly. The bull snakes and their relatives have a small flap in front of the opening of the windpipe which enables them to produce an extremely loud hiss. Many snakes vibrate their tails back and forth when excited, and if they happen to be in dry grass or leaves an audible whirring noise is produced. The extreme of this condition is seen in the rattlesnake's horny rattles, which are vibrated at an average rate of 50 times per second. The rattling sound, like the hiss, is a warning to enemies; it is not a lure nor a mating sound nor a signal to other rattlesnakes. Contrary to popular opinion, the number of rattles does not indicate the age of the snake. A new segment or rattle is added every time the snake sheds its skin, which occurs from one to five times a year, and many segments are broken off from time to time.

Vision is well developed in most snakes, but many burrowing snakes are virtually blind. The sense of smell is acute and is relied upon to a large extent in hunting food. Snakes have an auxiliary chemical sense that is widely employed during most activities. The tongue flicks out, picking up odors and carrying them to the roof of the mouth into contact with a sensory

SNAKE

receptor called Jacobson's organ. The tongue also receives touch stimuli. Snakes are deaf to airborne sounds. Thus a rattlesnake does not hear the sound of another snake's rattle, nor does the cobra hear the snake-charmer's flute. They can perceive vibrations through the ground or whatever they are resting on, however. The pit vipers, as well as some boas and pythons, have another kind of sense organ, a heat receptor that can perceive small differences in heat. In the pit vipers the heat receptor is located in the facial pit, between the eye and nostril, that gives the family its name; in the boas and pythons the receptor is located in the labial pits. By means of these receptors the snakes can locate and seize warm-blooded prey at night. See PIT VIPER.

Reproduction. Snakes reproduce either by laying eggs, which the mother usually abandons in some secluded spot, or by bringing forth living young, which are also abandoned. The number of eggs and young may number as many as a hundred at one time, but much smaller numbers are usually the case. Parental care is entirely absent as far as the young are concerned, but a few species guard the eggs during incubation and the female pythons actually brood them. Growth is fairly rapid and the young reach maturity in from one to five years. The greatest age known to have been attained by any snake is just under thirty years for both the anaconda and the black-lipped cobra. All snakes are carnivorous, eating a variety of animal life from insects, spiders, and snails to frogs, mice, and rats. Surprisingly enough, a number of snakes eat only other kinds of snakes.

Distribution. Snakes are found in all of the warmer parts of the world, except on a number of oceanic islands. They occur as far north as the Arctic Circle in Europe, but the number of kinds decreases rapidly from the tropics poleward. About 2500 different species are presently known. They are classified in eight to ten families, depending on the system of classification employed for some of the specialized, burrowing or arboreal, snakes. The family Colubridae is the largest family and includes the most common snakes on all continents except Australia, where the Elapidae outnumber all others. This latter group includes some of the most deadly snakes in the world, such as the mambas, cobras, and coral snakes. The other important family of venomous forms is the family Viperidae, which contains such well-known forms as the rattlesnakes, bushmaster, fer-de-lance, and the vipers. The largest snakes of the world are members of the family Boidae, which includes the

boas and pythons. Some members of this family never attain a length of more than 2 ft.; the giants of the family occasionally reach a size of more than 30 ft.

Snakes, through their carnivorous food habits, often play an important part in preserving the balance of life, particularly in the control of such pests as rodents, which tend to multiply at a rapid rate. Snakes are consequently of great service to agriculture in keeping down the numbers of injurious species that afflict the farmer; see ECOLOGY.

See also separate articles on most of the snakes mentioned in this article and illustrations in full color on opposite and following pages.

J.A.O. & S.A.

SNAKE, formerly LEWIS RIVER, largest tributary of the Columbia R. It rises in Yellowstone National Park in Wyoming. From Shoshone, Lewis, and Heart lakes in that park, the South Fork flows southward, widening into Jackson Lake (18 mi. long and 4 mi. wide), from which it passes through Jackson Valley (40 mi. long and 8 mi. wide). Near the Idaho-Wyoming boundary it enters a long canyon in which occur the famous Shoshone Falls (q.v.). It receives the North Fork in the s. part of Fremont Co., Idaho, and then flows westward across Idaho to a point near the Oregon-Idaho line. Here it turns suddenly N. and for about 170 mi. forms the boundary between those States and for more than 30 mi. between Idaho and Washington. It crosses into Washington at Lewiston, flows N.W., W., and S.W., and joins the Columbia near Pasco. The river is about 1000 mi. long.

SNAKEBIRD. See DARTER.

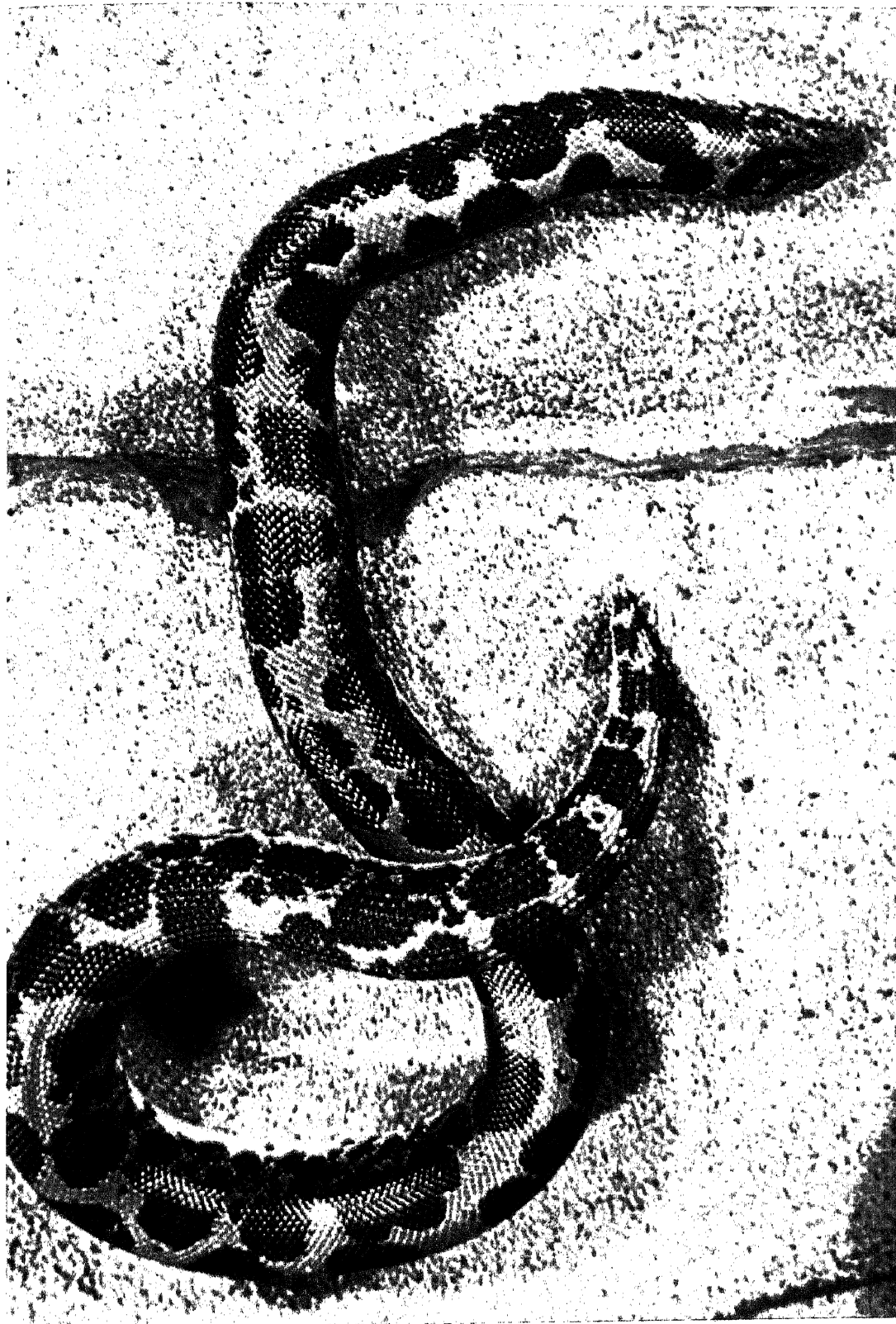
SNAKEBITE. See FIRST AID: *Animal Bite*.

SNAKE DANCE, ceremony of the Hopi (q.v.), or Moqui, Indians of northeastern Arizona in which the skilled handling of live snakes is a feature. The ceremony is held every two years at a date near August 20. The celebrants are the Snake and Antelope fraternities of the Hopi tribe. The dance, which is performed in public after eight days of secret ceremonies, is in effect a petition to the nature gods to bring rain. The Hopi believe that snakes are their brothers, the children of their ancestors the Snake Maid and the Snake Hero, who were changed into snakes, and that they therefore have special powers of intercession. See also PUEBLO (Indians).

SNAKE INDIANS. See SHOSHONI.

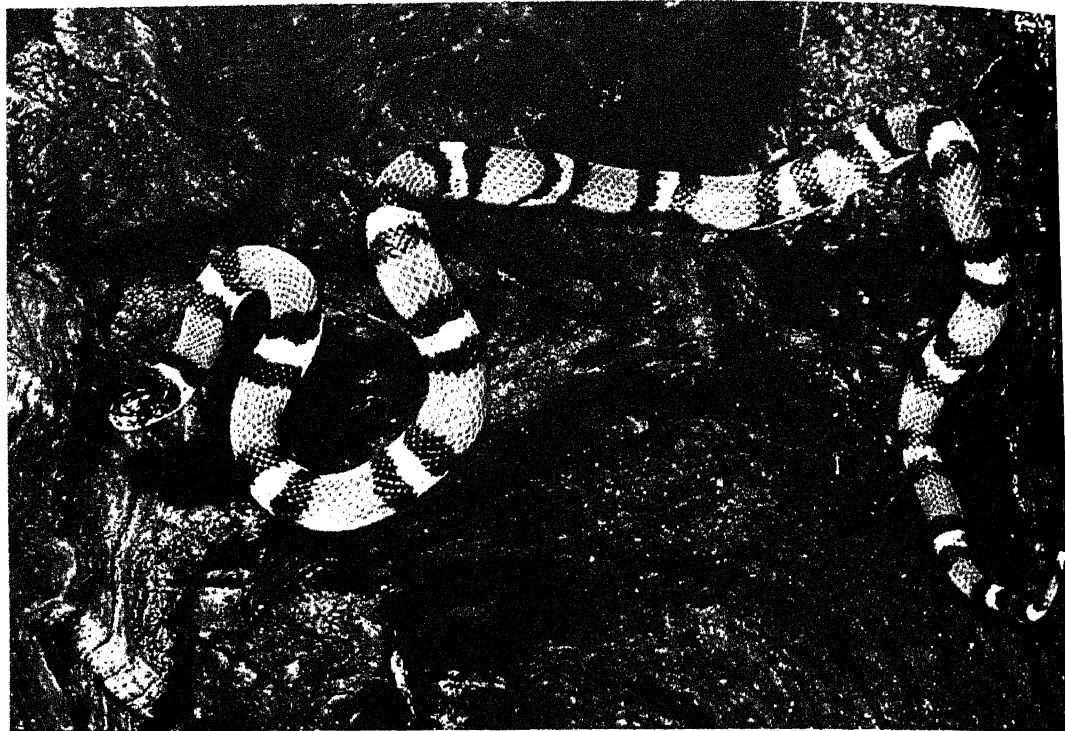
SNAKEROOT. See MILKWORT.

SNAPDRAGON, genus, *Antirrhinum*, of plants of the family Scrophulariaceae, consisting of annual and perennial herbaceous plants, chiefly natives of the temperate parts of the Northern



Snake. Plate 1. *The sand boa, Eryx colubrinus, is a small, burrowing, nonvenomous snake that is indigenous to arid regions of northern and central Africa and southwestern Asia.*

Dr. E. R. Degginger

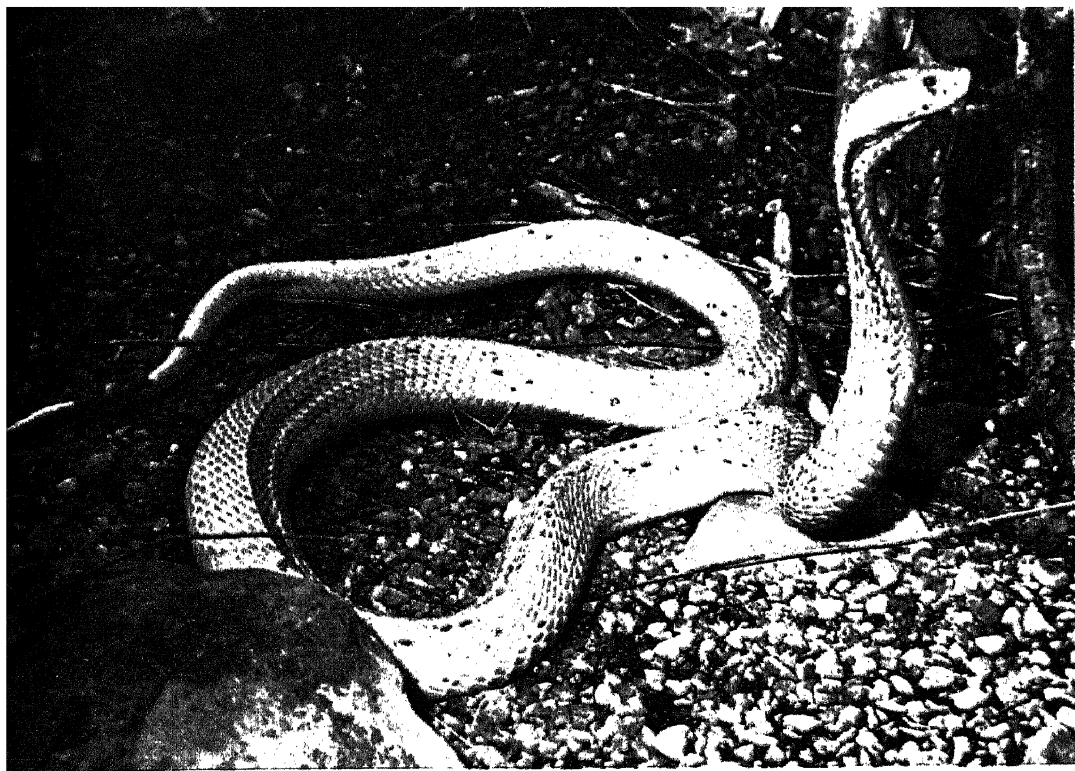


Dr. E. R. Degginger

Snake. Plate 2. Above: The so-called Louisiana snake, *Lampropeltis triangulum*. Indigenous to North America east of the Rocky Mountains, it resembles the deadly coral snake but is entirely harmless. Below: The Arizona coral snake, *Micruroides euryxanthus*, is indigenous to western Mexico and southwestern U.S.



Charles M. Bogert - American Museum of Natural History

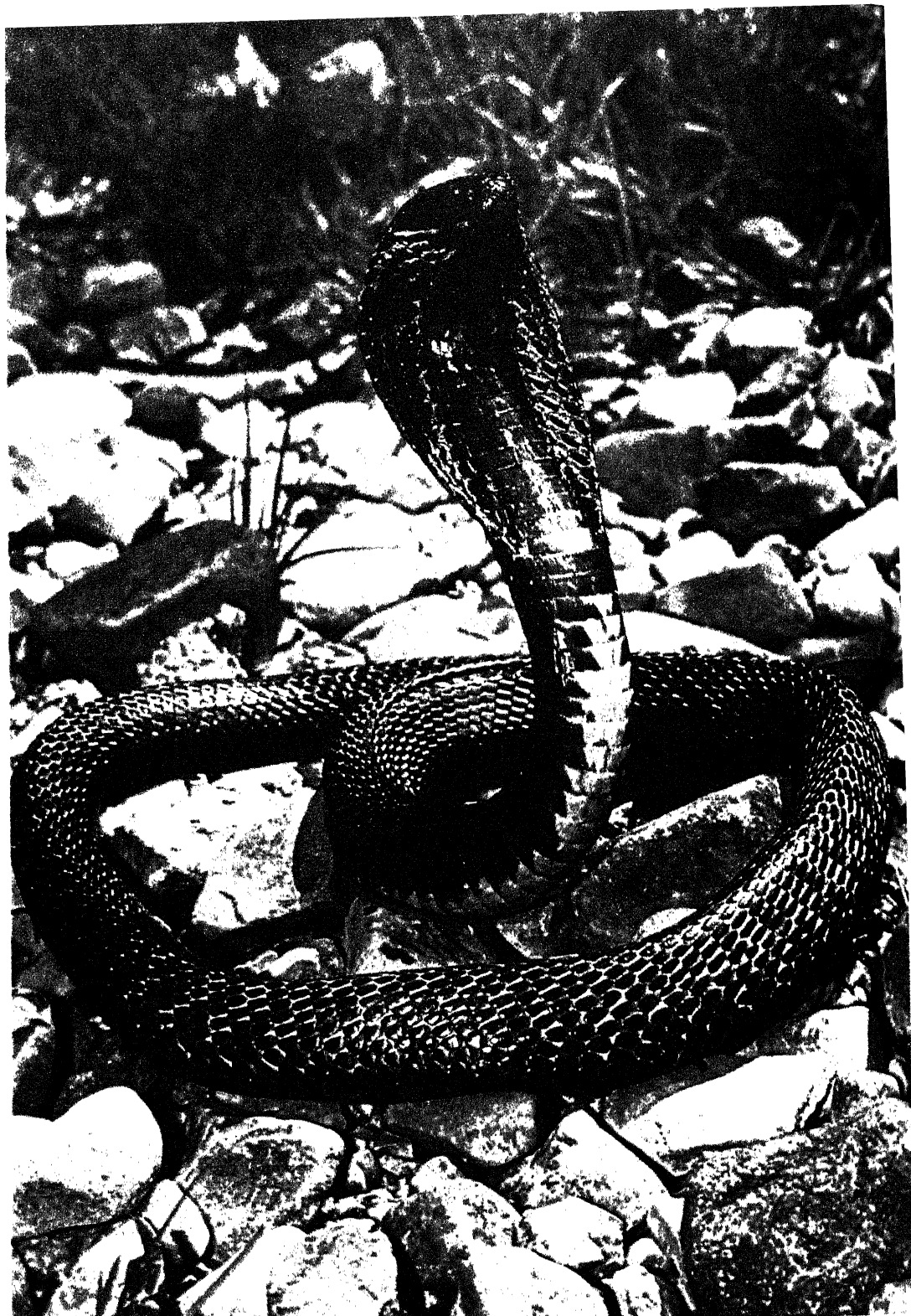


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Snake. Plate 3. Above: The Cape cobra, *Naja nivea*, is indigenous to southern Africa. Its coloring varies from white through yellow to brown and black. Below: Young pygmy rattlesnake, *Sistrurus miliaris*, is rarely more than 2 ft. long and is found in southeastern and south central United States.



Dr. E. R. Degginger



Snake. Plate 4. The poisonous black Indian cobra, *Naja naja*, in striking position. The typical hood of the cobra is formed by the extension forward of the side ribs into the neck and the consequent stretching of the skin. The lethal cobra grows to a length of up to $6\frac{1}{4}$ ft. and is estimated to cause more than 25,000 deaths a year on the Indian subcontinent.

Dr. E. R. Degginger

Hemisphere. They have a five-parted calyx and a corolla swollen at the base, but no spur. The name "snapdragon" refers to a peculiarity of the corolla, the lower lip of which, parted from the upper so as to open the mouth, shuts with a snap when released. The species *A. majus* is known also as dragon's-mouth.

SNAPPER, name given to several active, marine, carnivorous fishes of the family Lutjanidae and some other families on account of their voracity and quick biting at food. The best known and most valuable is the red snapper, *Lutjanus gibbus*, or pargo colorado, which is known on rocky banks as far north as New York, but is very numerous in the Gulf of Mexico. It reaches a length of 2 ft. or more and is one of the best of American food fishes. The gray snapper, *L. griseus*, sometimes called gray mangrove snapper or Pensacola snapper, in Florida attains an average weight of about 2 lb., but averages 5 lb. off Cuba.

SNAPPING TURTLE, large freshwater turtle, *Chelydra serpentina*, of the rivers and marshes of North and Central America, noted for its fierceness. It sometimes exceeds 3 ft. in length, but ordinarily is about half that. The jaws are large and strong, and grip so tenaciously on prey that the snapping turtle may sometimes be lifted from the ground by the object it bites. It feeds upon fish and all sorts of small aquatic animals. A second species, the alligator snapper, *Macrochelys temmincki*, occurs in the rivers of the southeastern United States. It is larger than the common snapping turtle, sometimes attaining a weight of 200 lb. These turtles, early in June, seek a sand bank, where the females dig holes with their hind feet and bury 25 or 30 small spherical eggs, smoothing the sand carefully over them. These two species constitute the family Chelydridae.

SNARE DRUM, also called SIDE DRUM, ordinary military drum and the smallest orchestral drum; see DRUM. It consists of a narrow, cylindrical metal shell, covered by two stretched drumheads, usually made of sheepskin, and is sounded by striking with wooden sticks. Tension of the skin, which controls pitch, is maintained or adjusted by side cords that are laced into hoops around the edges of the skin. The upper head is called the batter head; the lower, across which from four to ten snares (thin pieces of catgut or coiled wire) are stretched, is the snare head. The player usually wears the snare drum suspended at his side by a strap. See MUSICAL INSTRUMENTS: *Percussion Instruments*.

S.N.C.C. abbreviation for Student National Coordinating Committee (q.v.).

SNEAD, Sam(uel Jackson) (1912–), American professional golf player, born in Hot Springs, Va. He won the Professional Golfers' Association of America championship in 1942, 1949, and 1951; the Masters Tournament in Augusta, Ga., in 1949, 1952, and 1954; and the British Open championship in 1946. Snead was a member of nine United States Ryder Cup teams. He won the World Senior championship in 1964 and 1965, and in 1965 he also won the Greater Greensboro Open competition in North Carolina for the eighth time.

He wrote *Natural Golf* (1953) and *The Education of a Golfer* (1962).

SNIFE, common name applied to shore birds of the genus *Capella*, belonging to the family Scolopacidae, which includes also the woodcock and sandpiper (qq.v.). The genus includes about twenty species, widely distributed throughout the Northern Hemisphere. The snipe has a long, slender bill, which is sensitive at the tip, used to probe for worms and grubs in swampy grasslands. It is highly regarded as a game bird because of its twisting, erratic flight after it is flushed. Most species breed in the far north and migrate southward for the winter.

A typical species is the common American snipe, *C. gallinago*, known also as Wilson's snipe. It is mottled and striped with brown, black, and buff, and is about 11 in. in length. In courtship the male performs acrobatic revolutions in flight and drops suddenly from a height, producing a drumming beat as the air rushes past the quills in its wings.

SNOOKER. See BILLIARDS.

SNORRI STURLUSON (1179–1241), Icelandic historian, poet, and statesman, born in Odda. He became head of the highest Icelandic court in 1215 and in 1218 was invited to Norway by King Haakon IV (see under HAAKON) to negotiate a peace between their two countries. After returning to Iceland, he used his power to his own advantage and in 1239 was forced to flee to Norway. He went back to Iceland the following year and in 1241 was killed by his own son-in-law, Gissur (d. about 1264), supposedly on orders from King Haakon. Snorri Sturluson was the author of the *Younger Edda* or *Prose Edda* (see EDDA) and the probable author of the *Heimskringla* or *Sagas of the Norwegian Kings*. The *Sagas* extend from the mythological kings to 1177 and are based on chronicles, tradition, and legend. They reveal great literary ability and were frequently translated. See ICELAND: *History*; ICELANDIC LITERATURE: *The Saga*.

SNOW, precipitation of transparent ice crystals formed when water vapor in the atmos-

SNOW

phere (q.v.) is condensed at temperatures below freezing point (q.v.). Partly melted crystals usually cling together to form snowflakes that may grow in size up to 3 or 4 in. in diameter; see CRYSTAL.

Structurally, elemental crystals of snow occur in any of various hexagonal forms, depending upon exact atmospheric temperatures during formation. Among these six-sided, basically symmetrical shapes are needle, columnar or stud, platelike, and star-shaped crystalline types. Because of the infinite variability of weather conditions, however, every snow crystal is unique in its precise configuration, and it is the large number of reflecting surfaces of the crystal that make snow appear white. Meteorological observers have secured photographs of the crystals as seen through the compound microscope. The longer rays that constitute the arms of the six-rayed stars are generally hollow tubes; they are evidently built up by additions to the edge of an original crystal.

Snow is even more difficult to measure than rain. The action of the wind frequently interferes with falling snowflakes as they are about to enter a snow gage exposed to collect them or drives them out after they have entered the gage. Even moderate winds often remove the snow cover from the ground in some places while heaping deep drifts of snow in others. It is usual to state the quantity of snowfall as depth in inches, or some other unit, of newly fallen snow; it is also measured sometimes in terms of the depth of the layer of water that would result if the snow were melted in place. A.K.B.

SNOW, C(harles) P(ercy), Baron Snow of Leicester (1905–), British novelist, critic, and scientist, born in Leicester, England, and educated as a chemist and physicist at the University of Leicester and Christ College, University of Cambridge. He did scientific work in the 1930's and during World War II was chief of scientific personnel for the ministry of labor. He was named a Commander of the British Empire in 1943, knighted in 1957, and created lifepeer in 1964. Lord Snow is best known for a series of interrelated novels which examine English life between 1920 and 1950. The series is named after the first of these novels, *Strangers and Brothers*, which appeared in 1940. Others in the series of eleven novels include *Time of Hope* (1949), *The Masters* (1951), *The New Men* (1954), *The Affair* (1959), and *Last Things* (1970). His novels are usually concerned with scientists, university people, public servants, and politicians. In *The Two Cultures and the Scientific Revolution*, originally given as a series of lectures and later

(1959) published in book form, Snow urged a mutual understanding between scientists and men of letters. The 11-volume "Strangers and Brothers" series was continued with *Corridors of Power* (1964), a study of power politics in the British government, and completed with *Last Things* (1970). Snow was parliamentary secretary to the minister of technology, a member of the British cabinet, from 1964–66.

SNOWBALL, any of various deciduous shrubs of the genus *Viburnum*, in the Honeysuckle family, Caprifoliaceae, distinctive for their balllike clusters of white flowers resembling snowballs. The clusters are as much as 4 in. wide. The shrub is native to Europe, North Africa, and Asia and is also cultivated in parks in North America. One of the most common species is the guelder rose or snowball tree, *Viburnum opulus* (var. *sterile roseum*), which has maplelike leaves and grows from 8 to 12 ft. high; it is a form of the European cranberry bush; see CRANBERRY. Another species is the Japanese snowball, *V. tomentosum* (var. *plenum*). The name snowball is sometimes applied to similar plants of other genera, including *Hydrangea macrophylla*, which is sold as a potted plant in the United States; see HYDRANGEA. See also VIBURNUM.

SNOWBERRY, bushy American shrub, *Symphoricarpos albus*, of the Honeysuckle family, Caprifoliaceae. A congener of the coralberry, it is common in ornamental cultivation for its loose, leafy cluster of snow-white berries at the ends of the branches.

SNOWBIRD. See JUNCO.

SNOWDON, Great Britain, mountain group in Caernarvonshire, Wales. It is broken by valleys into five minor groups, whose chief peak (3560 ft. above sea level) is the highest mountain in s. Great Britain. A rack-and-pinion railway was built to the summit in 1895.

SNOWDROP. See GALANTHUS.

SNOW LEOPARD. See OUNCE.

SNOWMOBILE, gasoline-engine powered vehicle designed for rapid travel over snow-covered terrain. Traction generally is provided through a drive track, a belt of rubber reinforced by steel rods, at the rear of the vehicle. Although nearly fifty manufacturers produce snowmobiles, most models are driven by two-cycle one- or two-cylinder engines with between 10 and 25 h.p. The vehicles usually cruise at 45 m.p.h., but some racing models with more powerful engines can travel at speeds up to 90 m.p.h. Snowmobiles usually are steered by handlebars attached to a pair of skis at the front of the body. Exceptions to the general design of snowmobiles are vehicles equipped with six or

Snowmobiles are sometimes used on polar expeditions to help maneuver loaded sleds over ice blocks and ridges of the arctic terrain.

Seitz Organization, Inc.



eight large, low-pressure tires instead of a drive track and those powered by airplane-type ducted fan propulsion systems. Development of the snowmobile generally is credited to an American inventor, Carl J. Eliason, who devised a motorized toboggan in 1927. About 95 percent of the snowmobiles sold in the United States are used for winter recreation purposes; the remainder are work vehicles driven by police, telephone linemen, ranchers and farmers, trappers, and rescue squad crews. Snowmobiles have aroused growing controversy, however, because of criticism regarding their undue noise, damage to snow-hidden crops, and dangerous high speed.

SNUFF. See TOBACCO.

SNYDERS, Frans (1579–1657), Flemish painter, born in Antwerp. One of his teachers was the great Flemish painter Pieter Brueghel the Younger (see under BRUEGHEL). After making his reputation as a painter of flowers and fruit, he became a master of animal painting and did notable canvases of hunting scenes and animals in combat. Some of the best examples of these are "The Bear Hunt" (Kaiser Friedrich Museum, Berlin), "Fox Hunting" (Kunsthistorische Museum, Vienna), and "Stag Hunt" (Mauritshuis, The Hague). Snyder was court painter to the then governor of the Spanish Netherlands, Archduke Albert (1559–1621), and was employed to paint animals in large works by the Flemish artists Peter Paul Rubens and Jakob Jordaens (qq.v.).

SOAP, cleansing agent or detergent (see DETERGENTS) made from animal and vegetable fats, oils, and greases; chemically the sodium or potassium salt of a fatty acid, formed by the interaction of fats and oils with alkali.

History of Soapmaking. Early records mentioning the use of numerous soapy materials and cleansing agents date back to ancient times. The purifying agents mentioned in the Old Testament (Jer. 2:22 and Mal. 3:2) were not true

soaps, but were a product of tree bark ashes alone. The 1st-century Roman historian Pliny the Elder (see under PLINY) described various forms of hard and soft, dye-containing soaps known as *rutilandis capillis*, which had previously been used by women to cleanse and impart brilliant colors to the hair. Soapmaking was common in Italy and Spain during the 8th century. By the 13th century, when the soap industry was introduced from Italy into France, most soap was produced from the tallow of goats, with beech ash furnishing the alkali. The French, after experimentation, devised a method of making soap from olive oil instead of animal fats, and, about the year 1500, introduced their discoveries into England. The industry in England grew rapidly, and in 1622 was granted special privileges by King James I (q.v.). In 1783, the Swedish chemist Karl Wilhelm Scheele (q.v.) accidentally simulated the reaction that takes place in the present-day boiling process of soapmaking, described below, when he boiled olive oil with lead oxide, producing a sweet-tasting substance which he called *ölsüss* and which is now known as glycerin (q.v.). This discovery by Scheele led the 19th century French chemist Michel Eugène Chevreul (1786–1889) to investigate the chemical nature of the fats and oils used in soap; Chevreul eventually discovered, in 1823, that simple fats do not combine with alkali to form soap, but are first decomposed to form fatty acids and glycerols. Meanwhile, the manufacture of soap was revolutionized in 1791 by the French chemist Nicolas Leblanc (1742–1806), who invented a process for obtaining sodium carbonate, or soda (q.v.), from ordinary salt. In the early American colonies, soap was made from rendered animal fats and was processed mainly in the household, but by 1700 many areas derived their main income from the export of ashes and fats used in soapmaking.



Soapmaking in France in the 19th century.
Bettmann Archive

Ingredients. Oils and fats used are compounds of glycerin and a fatty acid, such as palmitic, or stearic acid (q.v.). When these compounds are treated with an aqueous solution of an alkali, such as sodium hydroxide, a process called saponification, they decompose, forming glycerin and the sodium salt of the fatty acid. The fat palmitin, for example, which is the ester of glycerin and palmitic acid, yields sodium palmitate (soap) and glycerin upon saponification. The fatty acids required for soapmaking are supplied by tallow, grease, fish oils, and vegetable oils, such as coconut oil, olive oil, palm oil, soybean oil, and corn oil. Hard soaps are made from oils and fats which contain a high percentage of saturated acids (see HYDROCARBONS), which are saponified with sodium hydroxide. Soft soaps are semifluid soaps made from linseed oil, cottonseed oil, and fish oils, which are saponified with potassium hydroxide. Tallow used in soapmaking ranges from the cheapest grades, recovered from garbage and used for cheaper soaps, to the best edible grades used for fine toilet soaps. Tallow alone yields a soap which is too hard and too insoluble to yield satisfactory lathering, and so it is usually mixed with coconut oil. Coconut oil alone yields a hard soap which is too insoluble for use in fresh water; it lathers in salt water, however, and is used as marine soap. Transparent soaps usually contain castor oil, high-grade coconut oil, and tallow. A fine toilet soap made of high-grade olive oil is known as castile soap. Shaving soap is a potassium-sodium soft soap, containing stearic acid, which gives a lasting lather. Shaving cream is a paste of shaving soap in coconut oil.

Functions. Most soaps remove grease and other dirt because some of their components

are surface-active agents, or surfactants. Surfactants have a molecular structure which acts as a link between water and the particles of dirt, loosening the dirt particles from the underlying fibers or other surfaces to be cleaned. The molecule can perform this function because one end is hydrophilic, attracted to water, and the other is hydrophobic, attracted to substances which are not soluble in water. The hydrophilic end is similar in structure to water-soluble salts. The hydrophobic part of the molecule frequently consists of a hydrocarbon chain which is similar to the structure of grease, oil, and many fats. The net result of this peculiar structure permits soap to reduce the surface tension (q.v.) of water (by increasing wetting) and adhere to and make soluble substances otherwise insoluble in water. Soap powder is a hydrated mixture of soap and sodium carbonate. Powdered soap, which is used in dispensers, is a dry soap which has been pulverized to a fine powder. Liquid soap is a solution of soft potassium soap dissolved in water.

In the late 1960's, the increasing concern over the pollution of water resources, the harmful chemical contents of soaps and detergents, such as phosphates, were actively discouraged. Instead, biodegradable agents that are easily broken down and digested by bacteria, came into widening use; see CHEMICAL COMPOUNDS, SYNTHETIC: *Soaps and Detergents*; WATER POLLUTION. **SOAP BOX DERBY, ALL-AMERICAN**, racing contest for boy drivers of homemade, solely gravity-propelled or coasting cars, held annually in Akron, Ohio, and sponsored internationally by the Chevrolet Motor Division of the General Motors Corporation. Local preliminary races leading to the all-American event receive joint

sponsorship from various newspapers, radio and television stations, and civic and fraternal groups. All expenses of finalists are paid, and the top nine winners receive substantial rewards, including college scholarships. The champion receives a \$7500 four-year scholarship to the college of his choice. National headquarters of the program are in Detroit, Mich.

Qualification and Rules. A competing driver must be at least eleven years of age and no older than fifteen, must have designed and built his own motorless vehicle, and must be the champion of his own community, as proven in a local race known as an Annual Gravity Grand Prix. Such local races are held in cities throughout the United States and in seven foreign countries.

Each competitor in the Soap Box Derby must build his car out of parts that together cost no more than \$35; this figure does not include the wheels and axles, however, which are supplied at cost by Chevrolet dealers. The specifications of derby cars stipulate a wheelbase of not less than 48 in., a length not exceeding 80 in., a width not more than 34 $\frac{1}{4}$ in., and a height not over 28 in. The total weight of car and driver must not exceed 250 lb. Each car is officially inspected.

Finals. Each August the all-American finals, composed of numerous heats, are held on a specially designed racing course in Akron known as Derby Downs. The course comprises a sloping, three-lane, straightaway track, 975.4 ft. long and 30 ft. wide, bordered by spectator grandstands. The track, originally of concrete, is today surfaced with green-painted macadam. It has an average grade of 6 percent; the steepest grade is 14 percent at the top, with the track tapering to 1.7 percent at the finish. Cars must start from a standstill. An average time for completion of the course is about 27 sec., with speeds averaging about 26 m.p.h.

Competition is divided into two classes, one for boys eleven or twelve years old and the other for boys from thirteen to fifteen. Trophies are awarded for different categories of performance. Electronic devices and motion-picture cameras insure equal starts and accurate decisions in the closely contested heats.

History. The Soap Box Derby was originated in 1933 by the American newspaper photographer Myron E. Scott (1907–). The first derby, held in Dayton, Ohio, was a local event. The following year Chevrolet assumed sponsorship and thirty-four cities sent entries. Akron became the permanent site of the all-American race in 1935, and Derby Downs was opened in 1936. The race

has been held every year since 1934, with the exception of a four-year suspension during World War II. Local derby competition has gradually spread to a growing number of cities, and the entry list now nears 260 each year. In the U.S. alone, an estimated 50,000 boys annually build and race Soap Box Derby cars.

SOAP PLANT, or **AMOLE**, any of several plants of the Lily family, Lileaceae, noted for their detergent properties, and native to fields in western North America. The soaplike substances in soap plants, known as saponins (q.v.), permeate the roots, bark, leaves, and fruit of the plants. Primitive American Indians used the plant to make soap and the saponins today are used in manufacturing detergents and foaming liquids for fire extinguishers. The California soaproot, *Chlorogalum pomeridianum*, is 3 to 5 ft. high and bears white star-shaped, purple-veined flowers, which open in the afternoon; and long grasslike leaves that grow up to 1 $\frac{1}{2}$ ft., directly from the underground bulb.

SOAPSTONE. See **STEATITE**.

SOBIESKI, John III. See **JOHN III SOBIESKI**.

SOCCER, or **ASSOCIATION FOOTBALL**, type of football game played principally with the feet and in this way distinguished from Rugby (q.v.) football and American football, in which carrying and throwing the ball are largely employed in addition to kicking. The rules for association football were first definitely promulgated in 1863 by the London Football Association, whence the name. Later the term "association" was abbreviated to "assoc", which was transformed into "soccer", as the game is commonly known today.

Field and Equipment. Soccer football is played on a field the maximum length of which is 130 yd. and the minimum 100 yd.; its maximum width is 100 yd. and the minimum 50 yd. The field is marked by end lines, or goal lines; sidelines, or touch lines; a halfway line; a penalty area; and a goal area. In the center of each goal line is set a goal consisting of two, vertical posts placed 8 yd. apart and connected by a horizontal crossbar 8 ft. from the ground. The game is played with a spherical ball not less than 27 in. and not more than 28 in. in circumference.

Play. The object of the game is to score more goals or points than the opponent. A goal is scored when the ball is kicked or headed, that is, propelled by the head, so that it passes between the goalposts and under the crossbar. A team is made up of 11 players, and the game is in charge of a referee, assisted by 2 linesmen or touch men.

SOCCER

The game is played in 2 halves of 45 min. each, with an interval of approximately 10 min. between halves, during which the teams change goals. Just before play, the team captains toss a coin and the winner of the toss has the option of a choice of goals or kickoff. The game begins with a place-kick by the center forward from the center of the field. He usually elects to kick the ball a short distance to either side so that a nearby teammate may play the ball.

Throughout the game the ball is driven only by kicking it or by bouncing it off the head (heading). Use of the hands is prohibited except in the following situations. Either goalkeeper may pick up the ball with his hands when it comes within his penalty area; he may then carry the ball 4 steps and throw or kick it. In addition, if the ball goes across the touch line, a player of the side that did not force it out throws it by hand into the playing field. Two types of kicking are employed to advance the ball toward the opponents' goal: the long kick, by means of which the player kicks the ball to another player, or kicks it off the field; and the dribble, by means of which the player, while running, propels the ball by a succession of slight kicks, keeping it always under his control.

Special Rules and Penalties. The rules of soccer forbid tripping, holding, or pushing. Players may block their opponents with their bodies, but they may not charge into opposing players from behind. The opponent of the team committing a violation of these rules is permitted a try at goal by a free kick from a point near the goal. The various types of free kicks include the direct kick, from which a goal can be scored against the offending team; the indirect free kick, from which a goal cannot be scored unless the ball has been touched by a player other than the kicker; and the 11-m penalty kick, which is awarded by the referee when a defending team has committed a serious foul in its own 16-yd. penalty area. If a player kicks the ball across his own goal line or the ball bounces across his goal line off any part of his body except his hands, an opposing player is allowed to kick the ball into play by means of a corner kick. This is a kick taken 1 yd. from the corner flag marking the juncture of the goal line and the touch line.

International Competition. Soccer, both professional and amateur, is a popular game all over the world and the national sport of a great many countries. It is often regarded as the world's greatest spectator sport. Games played in Maracana Stadium, Rio de Janeiro, Brazil, which is the largest sports arena in the world, have attracted as many as 209,000 paying spectators.

The international governing body of soccer is the Fédération Internationale de Football Association (F.I.F.A.), with headquarters in Zürich, Switzerland. Competition for the World Soccer Championship, also called the World Cup or the Jules Rimet Cup, takes place every four years. Winners of the cup have been Uruguay, 1930; Italy, 1934; Italy, 1938 (competition suspended 1942-46); Uruguay, 1950; West Germany, 1954; Brazil, 1958; Brazil, 1962; England, 1966; Brazil, 1970; and West Germany, 1974.

In the United States the game of soccer is played on both amateur and professional levels. Much of the play is organized through the United States Soccer Football Association (U.S.S.F.A.), which was formed in 1912 and has been a member of the F.I.F.A. since 1913. The North American Soccer League (N.A.S.L.), established in 1967, consists of professional teams in the U.S. and Canada.

SOCHI, city and port of the Soviet Union, in the Russian S.F.S.R., on the subtropical Black Sea coast at the mouth of the Sochi R., 105 miles s.e. of Krasnodar. Lying at the foot of the Caucasus Mts., it is one of the principal health resorts of the country, with sulfur springs and many sanatoriums. The region grows citrus fruit, tobacco, and tea, and the city has tobacco- and food-processing, meat-canning, and dairying industries. Sochi is the site of the Ostrov Museum, a state theater (1937), a botanical garden, and an agricultural experimental station. Founded in 1896 as Dakhovskiy, the spa developed after 1910 and was chartered in 1926. Growing considerably after 1933, it became a city in 1948. Pop. (1970) 224,000.

SOCIAL AND REHABILITATION SERVICE (S.R.S.), agency of the United States Department of Health, Education, and Welfare established in 1967; see HEALTH, EDUCATION, AND WELFARE, DEPARTMENT OF. The service exists to strengthen and coordinate the major social-service, rehabilitation, and income-support programs of the Department of Health, Education, and Welfare. The programs are funded at about \$8,000,000,000 a year. The S.R.S. grants financial help to States to upgrade the quality of life for the aged, the mentally and physically disabled, the blind, and needy families with dependent children; and it administers Medicaid, a program that aids States to provide hospital, nursing-home, and other essential health services to eligible needy persons; see MEDICARE AND MEDICAID. The S.R.S. also assists community programs for older Americans; administers cash assistance for the needy under public-assistance programs; develops social services for children, families, youth,

and adults; provides health and medical-care services for low-income persons; administers vocational rehabilitation programs for the disabled and disadvantaged; provides services to prevent and reduce delinquency; and administers a Cuban refugee program for relocation, training, and placement of Cuban refugees.

SOCIAL CONTRACT, voluntary agreement among men defining the relationship of individuals with each other and with government and by this process forming a distinct organized society. Concern over the origin and conditions of political obligation was manifest even in the writings of philosophers and statesmen in ancient Greece and Rome. Such ideas were not systematically formulated, however, until the latter part of the 16th century, when Protestant philosophers sought a democratic principle with which to oppose the authoritarian theory of the divine right (q.v.) of kings. In the 17th and 18th centuries the theory of a social compact among individuals of a society was linked with the doctrine of natural law (q.v.). For the development and historical importance of the major social-contract theories as expounded by the English philosophers Thomas Hobbes and John Locke and the French philosopher Jean Jacques Rousseau (qq.v.), see *POLITICAL THEORY: The Social Contract*. See also *GOVERNMENT*; *STATE*.

SOCIAL-CREDIT MOVEMENT, reform movement that urges the elimination of social and economic inequities in capitalist society through a reformation in the currency and banking systems. It was formulated after World War I by the British civil engineer Clifford Hugh Douglas (1879–1952). He argued that the banks dominate the economic system and have usurped from the community as a whole the function of creating purchasing power. Thus consumers, deprived of sufficient purchasing power, are unable to buy the goods and services they produce as workers.

Douglas proposed to increase consumer purchasing power through the sale of goods and services at prices fixed by the government, in accordance with his own formula, at less than cost as originally calculated by producers. To reimburse producers for the losses they would otherwise sustain, he proposed that the government issue credits to them out of new money created by the government. He further advocated that the government become the only institution entrusted with the functions of creating currency and credit.

Although social-credit doctrines were rejected by almost all economists, the theory was welcomed among poor farmers and other debt-

ors. The most notable influence of social-credit theory on government policy occurred in the Canadian province of Alberta. There, William Aberhart (1878–1943), a Canadian politician and evangelist, organized the Social Credit Party and led it to a victory in the provincial election of 1935. Legislation was enacted by the Alberta legislature in 1936 and 1937 applying social-credit ideas but was invalidated as unconstitutional in 1938 by the Supreme Court of Canada. In the same year the court's decision was upheld on appeal to the privy council of the (British) Commonwealth of Nations. The movement, modified as a result of these decisions, gained popularity in British Columbia and in 1952 won the general elections in that province. In Federal politics, as many as nineteen members of the Social Credit Party represented Alberta, British Columbia, and Saskatchewan in the House of Commons between 1935 and 1957, but all Social Credit seats in the Federal lower house were lost in 1958.

In 1962, the Social Credit Party returned its largest representation to the House of Commons with 30 members, 24 from the province of Québec. By 1965, the Québec social creditors under Real Caouette (1917–) had formed a new party known as the Ralliement de Créditistes which still proclaimed the social-credit doctrine. By the time of the Federal elections in 1972, the differences between the two factions had been overcome, and the Social Credit Party obtained 15 seats in the House of Commons, all from Québec.

Thirty-six years of Social Credit power in Alberta came to an end when the party was defeated by the Progressive Conservative Party in 1971. The Social Credit Party of British Columbia suffered defeat by the New Democratic Party in 1972, after twenty years in power. In Québec, the party held 12 seats in the national assembly in 1970, but lost 10 seats in the elections of 1973.

SOCIALISM, economic and social doctrine, political movement inspired by this doctrine, and system or order established when this doctrine is organized in a society. The socialist doctrine demands state ownership and control of the fundamental means of production and distribution of wealth, to be achieved by reconstruction of the existing capitalist or other political system of a country through peaceful, democratic, and parliamentary means; see *CAPITALISM*. The doctrine specifically advocates nationalization (q.v.) of natural resources, basic industries, banking and credit facilities, and public utilities. It places special emphasis on the



Rosa Luxemburg

UPI

nationalization of monopolized branches of industry and trade, viewing monopolies as inimical to the public welfare; *see* MONOPOLY. It also advocates state ownership of corporations in which the ownership function has passed from stockholders to managerial personnel. Smaller and less vital enterprises would be left under private ownership, and privately held cooperatives would be encouraged; *see* COOPERATIVE MOVEMENT.

These are the tenets of the Socialist Party (q.v.) of the United States, the Labour Party (q.v.) of Great Britain, and labor or social democratic parties of various other countries. Therefore they constitute the centrist position held by most socialists. Some political movements calling themselves socialist, however, insist on the complete abolition of the capitalist system and of private profit, while at the other extreme are socialist programs having objectives entailing even fewer changes in the social order than those outlined above. The ultimate goal of all socialists, however, is the establishment of a classless cooperative commonwealth in every nation of the world.

Distinct from Communism. The terms "socialism" and "communism" (q.v.) were once used interchangeably. Today, however, communism designates those theories and movements which, in accordance with one view of the teachings of the 19th-century German political economists Karl Marx and Friedrich Engels (qq.v.), advocate the abolition of capitalism and

all private profit, by means of violent revolution if necessary. Marx organized the International Workingmen's Association (q.v.) or First International; when this congress met at Geneva, Switzerland, in 1866 it was the first international forum for the promulgation of communist doctrine. This doctrine was later expanded by the Russian revolutionary Vladimir Ilich Lenin (q.v.), first premier of the Soviet Union, who defined a socialist society as one in which the workers, free from capitalist exploitation, receive the full product of their labor. Most socialists deny the claim of Communists to have achieved socialism in the U.S.S.R., which they regard as an authoritarian tyranny. But after World War II, many Communist-led political parties in the Russian sphere of influence still used the designation "socialist" in their names. In East Germany, for example, the name adopted by the merged Communist and Social Democratic parties was the Socialist Unity Party.

The modern socialist movement, as distinguished from communism, had its origin largely in the revisionist movement of the late 19th century. The worsening condition of the proletariat or workers and the class war predicted by Marx for Western Europe had not come about. Many socialist thinkers began to doubt the indispensability of revolution and to revise other basic tenets of Marxism. Led by the German writer Eduard Bernstein (q.v.), they declared that socialism could best be attained by reformist, parliamentary, and evolutionary methods, including the support of the bourgeoisie (q.v.).

Moderate Socialism. Such a view was held by the founders of the Fabian Society (q.v.), organized in 1884 by British social reformers Sidney and Beatrice Webb (*see under* WEBB) and their

Karl Johann Kautsky

UPI





The first Labour Party cabinet of Great Britain, elected in 1924 and headed by James Ramsay MacDonald (front row, fifth from left). UPI

associates. The Fabians in turn helped to form the British Independent Labour Party in 1893; it became affiliated with the newly organized Labour Party in 1906. In the U.S. a small Socialist Labor Party was founded in 1877. This party, small as it was, became fragmented in the 1890's. In 1901, a moderate faction of the party under Morris Hillquit (q.v.) joined with the Social Democratic Party of Eugene V. Debs (q.v.) and the Christian Socialists of George D. Herron (1862–1925) to form the Socialist Party.

The moderate or revisionist type of socialism found its clearest expression in the organization in Paris in 1889 of the Second International (q.v.). This body differed from the First International in that it was merely a coordinator of the activities of its affiliated political parties and trade unions. The Second International also diverged in ideology; a majority of its members, led by Eduard Bernstein, were revisionists. The left-wing minority was led by Lenin and the German revolutionist Rosa Luxemburg (q.v.); a third element, Marxist but opposed to Lenin, was led by the German theorist Karl Johann Kautsky (q.v.). The Second International declared its opposition to the preparations for war being made by most European governments.

Rise of the Left Wing. When World War I began in 1914, moderate European socialist leaders supported their respective governments. Leaders of the Socialist Party in the U.S. and of the Labour Party of Great Britain did not. Spokesmen for the left wing, led by Lenin, labeled the war an imperialist struggle and urged the workers of the world to convert the war into a proletarian revolution or to turn the imperialist war into a class war. This ideological conflict resulted in the collapse of the Second International. Revived after World War I, it was never again important.

Despite the decline of the Second Interna-

tional, socialist parties made substantial gains during the years following World War I and during World War II. In Great Britain, the Labour Party under James Ramsay MacDonald (q.v.) was in power for ten months in 1924 and again from 1929 to 1931 but it lacked parliamentary majorities and accomplished little. In Australia the Labour Party held office from 1929 to 1932, 1941 to 1949, and was returned to power in 1972. The Labour government of New Zealand, elected in 1935, remained in power until 1949. In Scandinavia, candidates of the Social Democratic parties of Denmark, Norway, and Sweden were elected to high positions early in the 1920's; these parties subsequently became dominant in Scandinavia.

Socialism vs. Fascism. During the 1920's and 1930's socialist and communist parties were in continuous conflict. One point of contention was the question of support for the U.S.S.R. Socialists castigated communists as agents of Russia and traitors to their own countries. Also during the 1920's and 1930's, fascist regimes in Germany and Italy caused both socialists and communists to develop new tactics; see FASCISM; NATIONAL SOCIALISM. Attempts were made in several countries to form a united front of all working-class organizations opposed to fascism, but the movement had limited success, even in France and Spain, where it did well in the 1936 elections. Failure of the communists and socialists of Germany to unite is regarded as one cause of the success of the National Socialists. The fragile alliance that was achieved between socialists and communists in some countries during this "Popular Front" period was destroyed in 1939 by the conclusion of a non-aggression pact between Germany and the

SOCIALISM

U.S.S.R. Socialists condemned this act as a demonstration of the community of interest between two totalitarian governments. In August, 1939, Germany invaded Poland, precipitating World War II, and socialists in the Allied countries immediately expressed full support of their respective governments.

After World War II. An upsurge occurred in support of socialist parties after the war, chiefly in Western Europe. The greatest advance was scored in Great Britain in 1945; the victorious Labour Party had in its campaign advocated the socialization of the British economy. In ensuing years individual socialists won victories and in some instances formed governments in France, Italy, Belgium, the Netherlands, Norway, Sweden, and numerous other European countries. The Socialist International, similar to the Second International, was organized in 1951 in Frankfurt, West Germany. In Asia, socialism made progress in India, Burma, and Japan; the Asian Socialist Conference was formed as the Eastern equivalent of the Socialist International. The Soviet satellites, the "People's Democracies" of Eastern Europe, including Poland, Czechoslovakia, Hungary, Bulgaria, and Rumania, came under the control of Communist-Socialist parties, but these were dominated in all cases by Communists. China established a Communist government, as did Albania and, later, Cuba. Emerging nations of Africa, Asia, and Latin America frequently adopted social systems that were largely socialist in orientation. In many instances, these nations took over properties held by foreign owners. The influence of the Socialist Party of the U.S., led from 1924 to 1968 by Norman Thomas (q.v.), gradually declined, although much of its economic program became law under the New Deal (q.v.) of President Franklin Delano Roosevelt (q.v.).

The period following World War II was also marked by intensification of the conflict between socialists and Communists. Socialists approved such measures, initiated in the U.S. and supported by the governments of Western Europe, as the European Recovery Program and the North Atlantic Treaty Organization (qq.v.), declaring that the former would stem the tide of totalitarian Communism by raising living standards and that the latter would achieve the same end by strengthening Western Europe militarily. Communists denounced these measures as imperialist preparations for war against the U.S.S.R.

While socialist political parties may suffer occasional setbacks in elections in those countries in which they form half of the two-party system, as in New Zealand in 1960 (they had been re-

turned to power in 1957 and did regain power in 1972), and in Great Britain in 1970 (after six years in power), it must be noted that extensive and fundamental parts of the socialist program are permanent features of contemporary economic and social life.

N.T. & R.E.Bu.

SOCIALIST, INTERNATIONAL. See SECOND INTERNATIONAL.

SOCIALIST PARTY, political party of the United States, founded in Indianapolis, Ind., in 1901. The first political party in the U.S. dedicated to the promotion of socialism (q.v.) was the Socialist Labor Party, founded in 1877. In 1890 leadership of this party was assumed by Daniel De Leon (q.v.), an authoritarian follower of the revolutionary policies of the German political economist Karl Marx (q.v.). In 1899, moderate members of the Socialist Labor Party, led by the American lawyer Morris Hillquit (1869–1933), resigned. Meanwhile, in 1898, the Social Democratic Party had been founded by the American labor leader Eugene V. Debs and the American editor and legislator Victor Berger (qq.v.). This party had some early success in local elections in Massachusetts, and Debs received 95,000 votes as its Presidential candidate in 1900. The American Congregationalist minister George Davis Herron (1862–1925) became a Socialist in 1899, hoping to give the movement a Christian orientation. In 1901 Hillquit and his faction of the Socialist Labor Party joined Debs, Berger, and other Social Democrats and the Christian Socialists to form the So-

Eugene V. Debs (left), Socialist Party leader, with Jean Longuey, French Socialist, in Chicago after Debs' first public speech following his release from prison in 1921.

UPI



cialist Party of America. By 1912 party membership had increased to approximately 118,000. Debs, Presidential candidate of the party in 1904 and 1908, received 900,672 votes (6 percent of the popular vote), in the 1912 Presidential election. In that year the party had more than 1000 members in public office. The reformist policies or "immediate demands" of the party, dedicated to achieving socialism through peaceful democratic methods, were disseminated by influential publications. The party also played an important role in the growth of trade unions (q.v.) in the U.S.

The Socialist Party denounced World War I and the belligerent role of the U.S. in what it regarded as an imperialist conflict although some of the party's leaders resigned to support the war. Debs was arrested in 1917 for making an anti-war speech in Canton, Ohio, and sentenced to ten years in prison under the Espionage Act of 1917 (q.v.). In 1920, while in prison, he was again the party candidate for the Presidency and received 919,799 votes. This was the largest vote ever cast for a Presidential candidate of the Socialist Party. Meanwhile, the Russian Revolution (q.v.) of 1917 led to a split in the party. The left wing, which later constituted the Communist Party, advocated similar revolutionary methods and the establishment of a workers' dictatorship in the U.S. Following the party split, in 1919, the Socialist Party declined in membership to approximately one-fourth its former size.

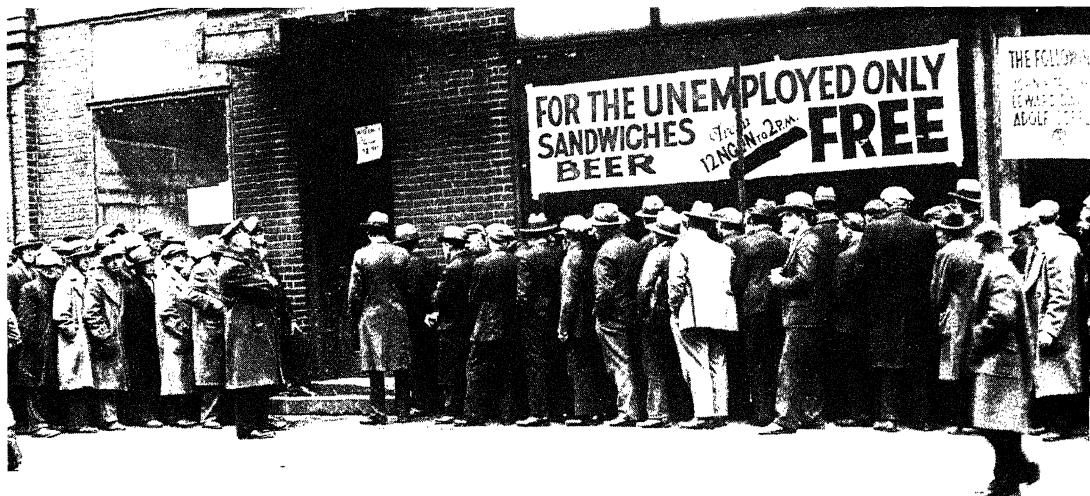
In 1924 the Socialist Party, striving to create a farmer-labor coalition, endorsed U.S. Senator Robert M. La Follette (*see under* LA FOLLETTE), Presidential candidate of the Conference for Progressive Political Action. La Follette polled 4,831,289 votes. After the dissolution of the La Follette movement, the Socialist Party was led by Norman M. Thomas (q.v.), the party candidate for the Presidency in six elections from 1928 through 1948. While the Socialist Party declined in numbers and influence, many of the social reforms it had advocated became accepted facts of American life. During the first administration of President Franklin D. Roosevelt (q.v.), much social legislation (q.v.) was passed which had first been advocated by Socialist Party members. In 1937 a split within the party resulted in the formation of the Social Democratic Federation, which subsequently supported national candidates of the Democratic Party. The last Presidential candidate of the Socialist Party was Darlington Hoopes (1896–), who received 20,203 votes in 1952 and 2192 write-in votes in 1956. In 1957 the So-

cialist Party and the Social Democratic Federation reunited. The resultant Socialist Party-Social Democratic Party, joined in 1958 by the left-wing Independent Socialist League, became a member of the Socialist International, a federation of world democratic socialist parties. Neither the new Socialist Labor Party nor the Socialist Workers Party, two smaller American political parties advocating international revolution, became a member of the Socialist International, and each of these parties does run independent candidates for office. In 1968, with the death of Norman Thomas, Darlington Hoopes was named honorary chairman of the party, and in 1970, he and the American labor leader A. Philip Randolph (q.v.) were named honorary co-chairmen. The party no longer runs its own candidates for office but remains an active educational and organizing force in such fields as labor and civil rights. In December, 1972, the party was renamed Social Democrats, U.S.A.; Bayard Rustin (1910–) became its chairman in 1974. N.T. & R.E.Bu.

SOCIALIZED MEDICINE. *See* MEDICARE AND MEDICAID; MEDICINE.

SOCIAL LEGISLATION, generic term used to denote the body of laws enacted in various countries, chiefly in the 19th and 20th centuries, to correct specific social and economic maladjustments. In general, such laws are designed to raise the standard of living and the cultural level of the economically depressed portions of the population. In recent times social legislation has also been effected to aid those segments of the general public affected by such business vagaries as spiraling costs of living and increased unemployment.

Among the many types of enactment comprehended in the term "social legislation" are laws providing for public assistance to the indigent and to the physically handicapped, for unemployment insurance, for old-age pensions, for compensation payments to workmen injured in the performance of their jobs, for public educational systems, and for slum clearance and public housing. Other examples are laws prohibiting or limiting the employment of women and minors, establishing minimum wages, and prohibiting discrimination against persons and groups because of race or religion. *See* CHILD LABOR; CIVIL RIGHTS AND CIVIL LIBERTIES; DISCRIMINATION; EDUCATION IN THE UNITED STATES; FACTORIES AND THE FACTORY SYSTEM; HOURS OF LABOR; HOUSING; LABOR RELATIONS; MINIMUM WAGE; OLD-AGE PENSIONS; UNEMPLOYMENT INSURANCE; WOMEN, EMPLOYMENT OF; WOMEN'S RIGHTS; WORKMEN'S COMPENSATION.



A breadline illustrates the plight of the unemployed in the U.S. during the economic depression of the 1930's, which much of the New Deal legislation of President Franklin D. Roosevelt was designed to alleviate. UPI

History in Europe. The concept of governmental assistance to the poor began to receive general acceptance in the 18th century, mainly in those countries in which society was undergoing a drastic reorganization as a result of the Industrial Revolution (q.v.). In England, where this transition began earlier than in other countries and where it was accompanied by the most severe economic maladjustments, a series of enactments known as poor laws was passed beginning in the 16th century for the relief of the growing numbers of poverty-stricken individuals and families. By the 19th century these laws had become inadequate, and in 1834 a basic reform was effected by the passage of a new poor law, which placed the administration of public relief on a uniform, organized basis. One of the chief provisions of this law stipulated that relief for the able-bodied unemployed and their dependents should be furnished only in workhouses, and that the nature and amount of the relief should not be such as to elevate the economic status of the recipients above that of the poorest laborers. The new poor law remained in effect for almost a century. Recurrent economic crises and consequent rises in poverty and unemployment put a heavy strain on the relief facilities provided under this law; although several successive parliamentary commissions recommended reforms, little legislative action was taken.

Not until 1930, when Great Britain was suffering from the severest economic depression in its history, was a new enactment, the Poor Law Act, passed in an attempt to deal with the rapidly deteriorating situation. A comprehensive program of social legislation was enacted by the La-

bour Party government that came into power in 1945. Included among the features of this program, which was aimed at providing lifetime security for the entire populace, were greatly expanded unemployment, sickness, and liability insurance; old-age pensions; workmen's compensation; a system of minimum wages; and a national health plan; see GREAT BRITAIN: *History: World War II: The Labour Party in Office*.

Elsewhere in Europe, the use of poor relief as a means of curing social ills was abandoned late in the 19th century in favor of legislation dealing with problems of a far broader scope. The most advanced countries in this respect were Germany and Sweden, where laws were passed between 1880 and 1890 regulating the employment of women and children and providing for workmen's compensation, unemployment and sickness insurance, and old-age pensions. Both of these countries continued their pioneering role well into the 20th century. The Swedish government enacted a program for the construction of low-cost public housing that served as a model for many other countries.

In Russia, social legislation was almost unknown before the Russian Revolution of 1917; see RUSSIAN REVOLUTION, THE. Subsequent legislation included social-insurance and public-health and welfare laws and led to the immense expansion of educational facilities, resulting in a drastic reduction of illiteracy. Soviet enactments in social insurance and public welfare are generally administered by the trade unions, rather than by the government; see UNION OF SOVIET SOCIALIST REPUBLICS: *The Economy*.

Development in the United States. In the United States, most relief for the poor was administered by private and local agencies until the middle of the 19th century. The first State board of charities was created in Massachusetts in 1863. Subsequently, public-welfare programs

began to replace outright charity. In 1910 the first board of public welfare was established in Kansas City, Mo. Many communities and States later formed similar agencies, and numerous laws were passed establishing government-administered systems of public welfare and regulating labor conditions.

After the election of President Franklin Delano Roosevelt (q.v.) in 1932, the body of social legislation known as the "New Deal" (q.v.) helped to alleviate the hardship caused by the economic crisis of 1929 and the subsequent depression. This legislation included the National Industrial Recovery Act, the National Labor Relations Act, the Fair Labor Standards Act (qq.v.), and the laws creating the Federal system of social security (q.v.). Various laws were enacted to aid economically distressed farmers; among these are the Agricultural Adjustment Act of 1933, which was later declared unconstitutional by the Supreme Court of the United States (q.v.), and the Farm Credit acts of 1933, 1935, and 1937, whereby loans were extended to needy farmers through Federal agencies (see FARM CREDIT ADMINISTRATION). In 1933 Congress passed the Home Owners' Loan Act, providing credit for home owners unable to meet mortgage (q.v.) payments. All Federal social legislation was administered by a specially created bureau, the Federal Security Agency, established in 1939.

In the years following World War II, President Harry S. Truman (q.v.) proposed a program of social legislation known as the "Fair Deal". Based on the achievements of the New Deal, it called for expanded social security; a national health-insurance program; an increase in the statutory minimum wage; the establishment of a Fair Employment Practices Commission, and a civil-rights division in the Department of Justice; the banning of the poll tax (q.v.); the classification of the crime of lynching (q.v.) as a Federal offense; the outlawing of racial segregation in public transportation facilities, restaurants, and schools; Federal aid to the State educational systems; and the initiation of a broad program of slum clearance and public-housing construction.

During the administration of President Dwight David Eisenhower (q.v.), the Supreme Court established the basis for future social legislation by declaring the racial segregation of public schools unconstitutional. Subsequent civil-rights acts prohibited racial discrimination in education, employment, and housing. Another accomplishment of the Eisenhower administration was the creation of a cabinet-rank

Department of Health, Education, and Welfare; see HEALTH, EDUCATION, AND WELFARE, DEPARTMENT OF.

Comprehensive social legislation on a vast scale was enacted under Presidents John Fitzgerald Kennedy and Lyndon Baines Johnson (qq.v.). In an effort to eliminate poverty in the U.S., the Office of Economic Opportunity (O.E.O.) was established in 1964; see POVERTY: *War on Poverty*. The Johnson administration also sponsored legislation for the assistance of students and educational institutions at all levels and developed Project Headstart, a program of education for preschool children (see PRESCHOOL EDUCATION). Medical assistance was provided through Medicare and Medicaid (q.v.), designed to defray the costs of medical attention for the elderly and the poor. Additional legislation, intended to deal with the problems of the urban environment included funding for housing projects, studies of mass transit and pollution, a rat-control bill, and experiments in the redevelopment of slum areas as embodied in the Model Cities Program. Studies were also made of hunger and malnutrition throughout the U.S.

In 1973, President Richard Milhous Nixon (q.v.) proposed a revamping of some social legislation programs and a phasing out of Federal responsibility in others. The Administration considered it more effective to rely on revenue sharing to make State and local governments more responsible for urban development and educational programs.

See also UNITED STATES OF AMERICA, THE: *History*. **SOCIAL PSYCHOLOGY**, branch of psychology that is concerned with the scientific study of the behavior of individuals as influenced, directly or indirectly, by social stimuli. Social psychology is interested in the thinking, emotions, desires, and judgments of the individual, as well as in his overt behavior. An individual's inner states can be inferred only from some form of observable behavior. Research has also proven that social stimuli affect the individual whether or not he is actually in the presence of others and that little an individual does or experiences is not to some extent influenced by present social or prior contacts.

Development of Theory. The roots of social psychology extend back to man's earliest intellectual probes into his relations with society. Many of the major problems of concern to contemporary social psychology were recognized as problems by social philosophers long before psychological questions were joined to scientific method. The questions posed by men such

SOCIAL PSYCHOLOGY

as the Greek philosopher Aristotle, the Italian philosopher Niccolò Machiavelli, the English philosopher Thomas Hobbes (q.v.), and others through history, still appear, albeit in rather different form, in the work of present-day social psychologists.

The more recent history of social psychology begins with the publication in 1908 of two textbooks concerned with the impact of society on the development and behavior of individual men and carrying the term "social psychology" in their titles. One of these was written by the British psychologist William McDougall (1871–1938), and the other, by the American sociologist Edward Alsworth Ross (q.v.). McDougall framed a controversial theory of human instincts, conceived of as broad, purposive tendencies emerging from the evolutionary process. Ross, on the other hand, was concerned with the transmission of social behavior from person to person, as with the influence of one person's emotions on another's in a crowd, or with the following of fads and fashions.

Another textbook on social psychology, published in 1924 by the American psychologist Floyd H. Allport (1890–), had an important influence on the development of social psychology as a specialization of general psychology. Allport extended the principles of associative learning to account for a wide range of social behavior. He thus avoided reference either to such mysterious social forces as were proposed by Ross or to the elaborate instinctive dispositions utilized by McDougall and his followers to account for social behavior. Through the remainder of the decade, the literature of social psychology continued to be devoted to similar discussions and controversies about points of view, and little empirical work, that is, work relying on experience or observation, of any theoretical or practical significance was done.

Early Experimentation. The 1930's marked the beginnings of empirical research on such matters as animal social behavior, group problem-solving, attitudes and persuasion, national and ethnic stereotypes, rumor transmission, and leadership. The German-American psychologist Kurt Lewin (1890–1947) emphasized the necessity of doing theoretical analysis before conducting research on a problem, with the purpose of the research being to clarify explanatory mechanisms proposed to underlie the behavior being studied. The theory from this point of view proposes an explanation of certain behavior and allows the investigator to predict the specific conditions under which the behavior will or will not occur. The investigator then de-

signs experiments in which the appropriate conditions are methodically varied and the occurrence of the behavior can be observed and measured. His results allow him to make modifications and extensions of his theoretical thinking.

In 1939 Lewin and two of his doctoral students published the results of an experiment of great historical importance. The investigators had arranged to have the same adults play different leadership roles while directing matched groups of children. The adults attempted to establish particular climates, that is, social environmental conditions, of democratic, autocratic, or completely laissez-faire leadership. The reactions of the children in the groups were carefully observed, and detailed notes were taken on many aspects of the patterns of social interaction that emerged. Although the experiment itself had many deficiencies, it demonstrated that something as nebulous as a democratic social climate could be created under controlled laboratory conditions.

The originality and success of this research had a liberating effect on other investigators. By the end of World War II, an outpouring of experimental research involving the manipulation of temporary social environments through laboratory stagecraft began. At the same time, important advances occurred in nonexperimental, or field, research in social psychology. The objective rather than the speculative study of social behavior is the current trend in social psychology.

Research Areas. Social psychology shares many concerns with other disciplines, especially with sociology (q.v.) and cultural anthropology (see ANTHROPOLOGY: *Cultural Anthropology*). The three sciences differ, however, in that while the sociologist studies social groups and institutions and the anthropologist studies human cultures, the social psychologist focuses his attention on how social groups, institutions, and cultures affect the behavior of the individual. The major areas of research in social psychology are the following.

SOCIALIZATION. Social psychologists who study the phenomena of socialization, meaning the process of being made fit or trained for a social environment, are interested in how the individual learns the rules governing his behavior toward other persons in his society, the groups of which he is a member, and individuals with whom he comes into contact. Questions dealing with how children learn language, sex role, moral and ethical principles, and appropriate behavior in general have come under intensive

investigation. Also widely studied are the methods by which an adult learns to adapt his patterns of behavior when confronted by new situations or organizations.

ATTITUDES AND ATTITUDE CHANGE. Attitudes have generally been regarded as learned predispositions that exert some consistent influence on responses toward objects, persons, or groups. Attitudes are usually seen as the products of socialization and therefore as modifiable. Because the behavior of a person toward others is often, although not always, consistent with his attitudes toward them, the investigation of how attitudes are formed, how they are organized in the mind, and how they are modified has been considered of great practical as well as theoretical importance.

The discovery that attitudes follow from behavior as well as vice versa emerges from the well-tested assumption that people desire to preserve a kind of logical consistency in their views of themselves and their environments. A number of theories of cognitive consistency have become very important in social-psychological thinking. These theories stress the idea that individuals have a personal stake in believing that their own thoughts and actions are in agreement with one another, and that perceiving inconsistency between one's actions and thoughts leads to attempts to reduce the inconsistency. Research attempts to understand the conditions under which a person will notice an inconsistency and the conditions under which he will attempt to reduce it by changing significant attitudes. Studies support the consistency-theory prediction that the attitudes of a person about a group of people can often be changed by inducing the person to change his behavior toward the group; the attitude change represents the efforts of the person to bring his ideas about the group into agreement with how he has just acted toward its members.

SOCIAL PERCEPTION. The question of how the individual perceives and evaluates characteristics of himself and others has been of major importance to some social psychologists. Investigators have studied such matters as the information a person selects and uses to make these judgments, and how a person infers unknown characteristics of another from other characteristics that he does know. Other investigators have focused on perception of the self and the development of self-image and self-esteem.

SOCIAL AFFILIATION, POWER, AND INFLUENCE. The factors that govern whether and with whom a person will affiliate, as well as whether and how he will attempt to influence or be influenced by

others, have received much attention by social psychologists. It has been found, for example, that if a person is unsure of how he should feel or behave in response to a new or unpleasant situation, he will seek the company of others who may be able to provide him with the information he lacks. It has also been found that in general, first-born and only children are more inclined to join groups throughout their lives than are later-born children.

GROUP STRUCTURE AND FUNCTIONING. Social psychologists have studied many issues related to questions of how the group and the individual affect one another. Among the points studied have been problems of leadership functions, styles, and effectiveness. Social psychologists investigate the conditions under which people or groups resolve their conflicts cooperatively or competitively and the many consequences of those general modes of conflict resolution. Research is conducted also to determine how the group induces conformity and how it deals with deviant members.

PERSONALITY AND SOCIETY. Some social psychologists are particularly concerned with the development and consequences of stable individual differences among people. Differences in the degree of achievement motivation have been found to be measurable and to have important consequences for how a person behaves in various social situations. Systems of attitudes toward authority, such as the notion of the authoritarian personality, have been found to relate to attitudes toward ethnic minorities and to certain aspects of social behavior. A personality syndrome known as Machiavellianism, named after Niccolò Machiavelli, has been used to predict the social manipulateness of people in interaction and their ability to dominate certain interpersonal situations.

Investigative Techniques. Numerous kinds of research methods and techniques are being used in social psychology. The tradition of theory-based investigation remains strong in the discipline. In recent years, rigorously exact mathematical models of social behavior have increasingly been used in psychological studies. Such models are projections, based on theory and in arithmetic detail, of social behavior in a possible system of social relationships.

Other techniques include the questionnaire and the interview, both used widely in public opinion polls and studies of consumer preferences. These two methods pose a considerable challenge to investigators. The kind of control of the environment that is possible in the laboratory is not available in the field, and the ef-

SOCIAL SCIENCES

fects of subtle factors that can be observed in experiments are easily obscured by other factors that may be occurring in natural environments.

Frequently, behavior in natural settings is systematically observed, or computers are programmed to simulate social behavior. Special techniques are used for analysis of statistics and other data and for attitude measurement as well as measurement of social choice and interpersonal attractiveness. Psychophysiological measurement, that is, measurement of shared mental and physiological characteristics, is also important. Cross-national and cross-cultural research, another modern technique, provides comparisons of behavior between nations and cultures; the same research study is carried out in several different countries in order to determine the cross-cultural validity of the research.

In the study of social behavior in animals, a laboratory environment facilitates the conducting of controlled experimentation, that is, experimentation considering the previous history of the animals as well as their present environmental conditions. Simple behavioral acts, as a pigeon pecking at an object, can be isolated and schedules of reinforcement, that is, repetition of stimuli, can be maintained. Social psychological research with animals has led to important new techniques for their training.

Applied Social Psychology. The principles developed in laboratory and field research in social psychology have been applied by practitioners to many social situations and problems. Applied researchers and consultants have worked to ameliorate problems found in ethnic relations, international relations, industrial and labor relations, political and economic behavior, education, advertising, and community mental health. Industries, organizations, schools, and task groups of many kinds regularly utilize the services of an applied social psychologist in such ways as to improve interpersonal relations, to increase understanding of relations between members of groups in conflict with one another, and to diagnose and help correct problems in group and organizational productivity.

See also CHILD PSYCHOLOGY.

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SOCIAL SCIENCES, sciences concerned with the origin and development of human society and the institutions, relationships, and ideas involved in social existence. The social sciences are sometimes defined as cultural sciences and as the sciences that deal with the activities of the individual as a member of a social group. Included in the social sciences are anthropology, sociology, political science, economics, history,

jurisprudence, penology, social work, social psychology (qq.v.), and economic geography (see GEOGRAPHY: *Cultural Geography*). Because they have in part a social content, philosophy, ethics, education (qq.v.), and comparative religion (see RELIGION: *Comparative Religion*) are generally included in the social sciences. Overlapping the social sciences in their social implications are such studies as biology, medicine (qq.v.), and linguistics (see LANGUAGE).

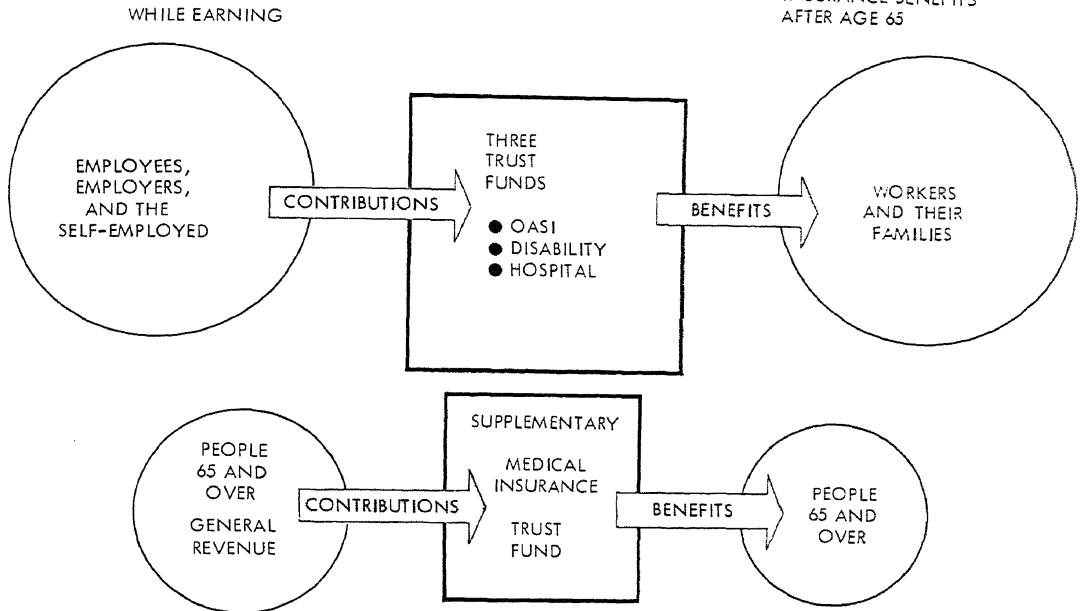
SOCIAL SECURITY, term used in the United States to designate the various programs established by the Federal and State governments to provide retirement, survivors, and disability insurance, health insurance for the aged, unemployment insurance, public assistance to the aged, the blind, the permanently and totally disabled, and dependent children, and financial support for maternal and child health and welfare services. The basic legislation is the Social Security Act of 1935, which created the Social Security Board. In 1946 the functions of the board were transferred to the Social Security Administration (q.v.), and in 1953 the administration was made a unit of the U.S. Department of Health, Education, and Welfare (q.v.).

Expansion of Coverage. Through a series of enactments, notably the nineteen Social Security Amendments passed between 1939 and 1974, Congress has greatly expanded the coverage and benefits of the basic insurance program, added new programs, and increased Federal grants for State and local assistance and welfare programs. The most recent amendment raised benefits by 11 percent; a onetime bonus was also granted in 1975.

Of this legislation, the amendments passed in 1956 and 1965 deserve particular mention. The 1956 legislation introduced disability insurance and the 1965 legislation added hospital and medical insurance for the aged to social-security provisions. Under these and other amendments the coverage of the program, originally limited to workers in industry and commerce, has been expanded gradually to include regularly employed agricultural and domestic workers, farmers, clergymen, self-employed persons (including medical doctors), and members of the armed forces. In the early 1970's almost all categories of employed and self-employed persons were covered except railroad workers and most Federal employees (who have special retirement programs), employees in some nonprofit organizations, and casual workers.

Retirement and Disability Benefits and Health Insurance. Retirement benefits, in varying amounts related to past earnings, are

THE BASIC IDEA OF THE PROGRAM



payable at the age of sixty-five (or, at reduced rates, sixty-two) for men and sixty-two for women. Disability benefits are payable to insured workers with mental or physical disabilities which prevent them from doing substantial gainful work for a year or longer. Supplementary benefits are paid to wives who are aged or have underage children and to dependent children of workers drawing retirement or disability insurance. These dependents also are entitled to survivor's benefits if an insured worker dies. Unmarried children qualify as dependents until age eighteen, or, if they are full-time students, until age twenty-two. Disabled widows, widowers, and some divorced wives may be eligible for benefits from age 50. Beginning in 1966, persons who were entitled to social security or railroad retirement benefits became eligible for hospital insurance, which is designed to cover most of the costs of hospital and posthospital care; see **HEALTH INSURANCE**.

The payments of retirement, disability, and hospital-insurance benefits all are financed from contributions made by covered employees and their employers and by the self-employed. Deductions are made from a worker's taxable earnings, counting only amounts up to \$6600 in 1968, \$7800 until 1973, then \$10,800, rising to \$13,200 in 1974; the employer must contribute an amount equaling that supplied by his em-

ployees; the self-employed contribution rate is about one-and-a-half times the employee rate and is made in connection with income-tax returns. To keep the system self-supporting, the rate of contribution gradually has been increased from 1 percent when the program began to 5.85 percent in 1973-77. It will continue to rise by steps to 7.3 percent in 2011. After 1957 the rate included an assessment to finance disability insurance, and after 1966, an assessment for hospital insurance. The Social Security contributions are administered in three separate trust funds, namely the Federal Old-Age and Survivors Insurance Trust Fund, the Federal Disability Insurance Trust Fund, and the Federal Hospital Insurance Trust Fund. A fourth, the Federal Supplementary Medical Insurance Trust Fund, receives the premiums of aged persons who voluntarily enroll in the program of supplementary medical insurance established by the 1965 social-security amendments; see **HEALTH INSURANCE**.

At the beginning of 1975, about nine out of ten gainfully employed persons in the U.S. were insured under social security, and over 31,000,000 were receiving monthly benefits totaling over \$58,190,000,000 annually.

Unemployment Provisions. The original Social Security Act included provisions to induce States to enact unemployment-insurance pro-

SOCIAL SECURITY

grams financed by a payroll tax on employers. By July, 1937, all States, Alaska, Hawaii, and the District of Columbia had passed laws for this purpose. Puerto Rico now also has an unemployment-insurance program which was incorporated in the Federal-State system in 1961. Although all State laws meet certain Federal standards, they vary in their eligibility requirements for unemployment compensation and in the amount and duration of payments. In January, 1975, the average weekly payment was over \$63. The duration of payments normally ranges from 22 weeks to 52 weeks. In the mid-1970's, because of high unemployment, Congress extended coverage for an additional 13 weeks in States with more than 4 percent unemployment.

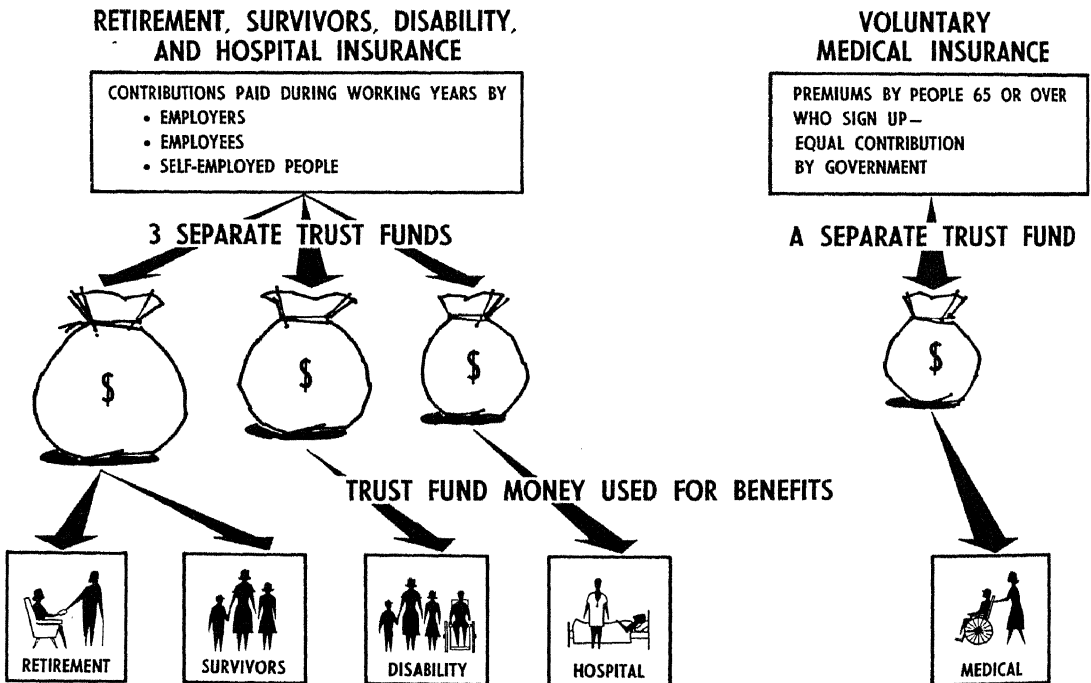
Other Programs. The Social Security Act also provides Federal grants to the States to pay part of the costs of aiding dependent children and needy people who are aged, blind, or permanently and totally disabled and of providing medical assistance for the aged and Medicaid for persons of all ages who cannot afford the costs of medical care. These programs are administered by the States, with the Federal government contributing a share of the payments for assistance and of the costs of administering

the programs. All fifty States, the District of Columbia, Puerto Rico, and the Virgin Islands have adopted programs of old-age assistance, aid to the blind, and aid to dependent children. By the late 1960's, forty-nine States and the District of Columbia had adopted programs of aid to the totally and permanently disabled; thirty-eight States and the District of Columbia had instituted Medicaid and nine States and the District of Columbia had special medical assistance programs for the aged. The outlying U.S. territories of Puerto Rico, the Virgin Islands, and Guam had adopted, by 1968, all the above-mentioned programs except medical assistance for the aged. Federal, State, and local expenditures during 1974 for these public-assistance programs totaled about \$28,836,000,000. See MEDICARE AND MEDICAID.

State and community health services for mothers and children also are supported partially by Federal funds. In 1974 about \$236,000,000 of Federal funds and \$233,000,000 in State and local funds were expended for maternal and child health services, which included prenatal clinics, child-health conferences, home-nursing visits, medical examinations in schools, nutritional, dental, and mental-health

SOCIAL SECURITY

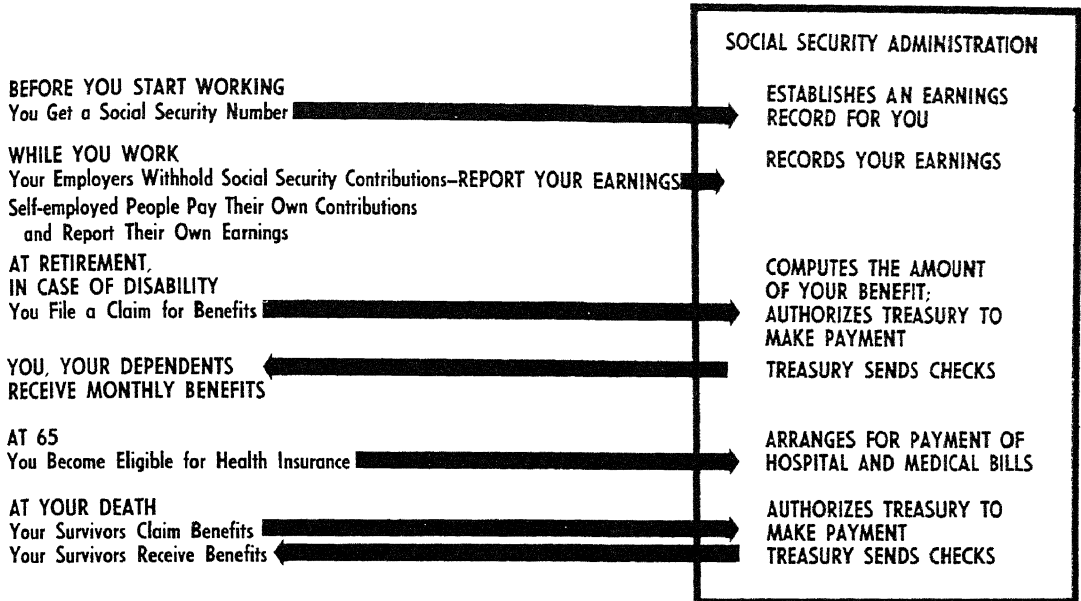
WHERE THE MONEY COMES FROM;
WHERE THE MONEY GOES.



Administrative costs for each program come out of the corresponding trust fund.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
SOCIAL SECURITY ADMINISTRATION

FROM SOCIAL SECURITY NUMBER TO SOCIAL SECURITY BENEFITS



programs, and aid to crippled children; see **MATERNAL AND CHILD WELFARE**. In the same year the Federal government also allocated \$45,000,000 for the protection and care of homeless and neglected children and children in danger of becoming delinquent.

C.I.S. SOCIAL SECURITY ADMINISTRATION, agency of the United States Department of Health, Education, and Welfare (q.v.), established in 1946. The Social Security Administration (S.S.A.) administers six income-maintenance and hospital-insurance programs. Social security (q.v.) is the nation's primary means of assuring a continuing income when family earnings stop or are reduced because of the retirement, death, or disability of the person who supports the family. Under social security, employees, their employers, and self-employed people pay contributions which are pooled in special trust funds. When earnings stop or are reduced because the worker retires, dies, or becomes disabled, monthly cash benefits are paid to replace part of the earnings lost.

Medicare, another social-security program, helps pay the cost of health care for people aged sixty-five and older; see **MEDICARE AND MEDICAID**. A portion of social-security contributions finance Medicare hospital insurance. Voluntary

medical insurance, also available under Medicare, is financed by monthly premiums paid by the people who sign up for this protection and by matching contributions by the Federal government.

In January, 1975, about 31,000,000 men, women, and children were receiving monthly cash benefits at the rate of more than \$5,000,000,000 each month. Nearly all of the 21,800,000 people in the nation aged sixty-five and over were eligible for hospital-insurance protection. About 95 percent of them also had protection under medical insurance.

SOCIAL WAR. See **ROME, HISTORY OF: The Republic: Internal Conflict (133–27 B.C.)**.

SOCIAL WORK, professional activity aimed generally at enrichment and enhancement of individual and group development or at alleviating the social and economic difficulties of persons whose position in society is adverse to their own interests and to those of society. Social work attempts to help individuals to join together locally or in larger geographic units to improve the conditions, laws, and policies under which they live. It seeks to enhance social planning and to prevent social breakdown, usually by providing care for homeless or neglected children, by attempting to rehabilitate the phys-

SOCIAL WORK

ically, mentally, and emotionally handicapped, and by extending financial aid to the poor and the aged. Where breakdown has already occurred, social workers carry out treatment, counseling, and direct-service activities to restore functioning, prevent intensification of problems, or rehabilitate those with considerable disability.

Formerly, all forms of philanthropic and charitable activities, including those carried on by untrained although well-intentioned and civic-minded individuals, were regarded as social work. Such activities, in part because they were conducted privately by people with little access to information on work being done by others, focused primarily on the solution of immediate problems of the needy only, and did little to change the conditions that caused those problems. More recently, however, a vast amount of new social research has made possible analyses of the social and economic maladjustments of modern society, and the activities of social workers have been coordinated in an effort to achieve the maximum possible benefit both for those in need and for the entire community.

Types of Social Workers. The areas in which a social worker may be employed are many and varied. Social caseworkers deal directly with the individual or the family. Usually they work through family-service agencies, medical and psychiatric hospitals and clinics, and public-assistance agencies. After determining the nature of the client's problems the caseworker tries to help him overcome them or to obtain the appropriate form of assistance. In recent years the areas of specialization within psychiatric and medical casework have increased greatly.

The social group worker is concerned usually with facilitating or leading activities of large groups of persons. He generally works in recreation centers, in social settlements such as those maintained by the American Red Cross and the Young Men's Christian Association (qq.v.), and in hospitals or other therapeutic settings.

Social-welfare planners are social workers who conduct research and help develop social welfare policies, frequently acting as proponents of social legislation (q.v.). Community organizers act as area-wide coordinators of all the programs of different agencies so as best to meet community needs for health and welfare services. They also facilitate self-help programs initiated by local common-interest groups, for example, by training local leaders to analyze and solve the problems of a community. Community organizers work actively, as do other types of social workers, in community councils of social

agencies and in community-action groups. At times the role of community organizers overlaps that of the social-welfare planners.

Social-Work Agencies. Social work is conducted by public and private agencies. In the United States, for example, the Federal government, operating through the Department of Health, Education, and Welfare, as well as the Office of Economic Opportunity, the Department of Labor, the Department of Housing and Urban Development (qq.v.), and other units, administers social welfare programs or provides funds that permit State, city, neighborhood, or private-agencies to operate many programs. These also include adoption, foster-home care, children's institutions, and juvenile-training schools, as well as local community organizations and neighborhood service centers. Further funds go to social-insurance programs, school social work, local psychiatric clinics and mental-health centers, Neighborhood Youth Corps, drug-abuse programs, programs to improve intergroup relations, and social-planning efforts. Many States, cities, neighborhoods, and voluntary agencies grant funds for similar and other programs. For the role of social workers in some of these fields, see ADOPTION; DRUGS, ADDICTION TO; JUVENILE DELINQUENCY; MATERNAL AND CHILD WELFARE; MENTAL HEALTH; SOCIAL SECURITY.

Training and Professional Material. Persons desiring to become fully qualified social workers are generally required to complete postgraduate courses, usually two years of study leading to the degree of master of science in social work. Such programs of study are offered at many universities. Social-work agencies collaborate with the universities in the training programs, thus enabling the students to obtain supervised experience in actual professional practice. Field training, that is, supervised training in an operating welfare agency, is required for most positions in social work.

The professional organization of social workers is the National Association of Social Workers (N.A.S.W.), with headquarters in New York City. During the early 1970's the association had 173 chapters with a membership in excess of 51,000. The N.A.S.W. publishes the quarterly magazine *Social Work Journal* and the *Encyclopedia of Social Work* (1965), as well as professional books and monographs.

See also separate biographies of famous social workers, for example, ADDAMS, JANE; LATHROP, JULIA CLIFFORD; WALD, LILLIAN D.; and articles on important social-work groups and settlements, as BIG BROTHERS OF AMERICA; HULL HOUSE; THE SALVATION ARMY.

A.J.K.

SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS. See ANIMALS, CRUELTY TO. **SOCIETY FOR THE PREVENTION OF CRUELTY TO CHILDREN.** See CHILDREN, CRUELTY TO. **SOCIETY ISLANDS,** archipelago, in the South Pacific Ocean, administered as a part of the overseas territory of French Polynesia; see POLYNESIA, FRENCH. The archipelago is located about 2400 miles s. of Honolulu and about 2300 miles n.e. of New Zealand. It is situated between about lat. 16°30' S. and lat. 17°47' S. and between about long. 148° W. and long. 157°20' W. The archipelago is divided into the Leeward Islands and the Windward Islands. Among the former islands are Raiatea, Huahine, Tahaa, and Borabora, and among the latter are Tahiti (q.v.) and Moorea. The islands are volcanic, mountainous, and surrounded by coral reefs that form coastal lagoons. The highest peak, Mt. Orohena, on Tahiti, has an elevation of 7352 ft. The climate is hot and humid. The principal agricultural products are coconuts, coffee, and vanilla, and the main exports include coffee, copra, mother-of-pearl, and vanilla. Tourism is also a major industry.

History. The islands were discovered in 1607 by the Portuguese navigator and explorer, Pedro Fernandes de Queirós (1560–1614). The first detailed description of the islands was written by the British explorer Captain James Cook (q.v.) after his visits in 1769, 1773, 1774, and 1777. The islands became a French protectorate in 1843 and a French colony in 1880. It became a part of the overseas territory of French Polynesia in 1958. The total area of the islands is about 650 sq.mi., of which Tahiti covers about 386 sq.mi.; the total population (census 1970) is 100,270.

SOCIETY OF JESUS. See JESUITS; LOYOLA, IGNA TIUS OF, SAINT.

SOCIETY OF THE CINCINNATI. See CINCINNATI, SOCIETY OF THE.

SOCINUS, originally SOZZINI or SOZINI, name of an Italian family that in the 16th century produced two theologians, noted as the founders of Socinianism, a system of Protestant religious doctrines (see PROTESTANTISM).

Laelius Socinus (1525–62), original name LELIO SOZINI, born in Siena and educated as a jurist. He studied Greek, Hebrew, and Arabic and engaged in extensive research on the Bible (q.v.). His Biblical research led him to a sympathetic interest in the work of the Protestant reformers (see REFORMATION), and he visited Switzerland, France, England, Holland, Germany, and Poland, meeting such Protestant leaders as the German scholar Melancthon and the French theologian John Calvin (qq.v.). During the last

years of his life he resided in Zürich. He wrote theological dissertations on the sacraments (see SACRAMENT) and on the Resurrection (q.v.) of the body and maintained an extensive correspondence with Protestant theologians. Although he questioned the doctrine of the Trinity (q.v.), he did not profess anti-Trinitarian views; he insisted, however, on the right to pursue free theological inquiry.

Faustus Socinus (1539–1604), original name FAUSTO SOZINI, nephew of Laelius, born in Siena and educated privately. In 1559 he was denounced by the Inquisition (q.v.) for holding heretical opinions and took refuge for three years outside Italy, visiting Zürich, Lyon, and Geneva. He returned to Italy about 1563 and for twelve years lived in Florence, conforming during that period with the regulations of the Roman Catholic Church (q.v.). In 1575 he settled at Basel and engaged in theological speculation and debates with Protestant leaders. Under the influence of his uncle's writings, he developed a radical doctrinal system, named Socinianism after both theologians. This system substituted the Unitarian concept of Jesus Christ (q.v.) as a man and as a deputy of God for the doctrine of Christ as divine and as a manifestation of a Trinitarian Godhead; see TRINITY; UNITARIANISM. Socinianism denied also the dogmas of the inborn total depravity of man (see EVIL, ORIGIN OF) and the atonement (q.v.) of Christ for the sins of man; the potency of the sacraments (see SACRAMENT); and the possibility of eternal damnation (see HELL).

About 1579 Socinus went to Poland and there spent the remainder of his life extending the influence of Socinian tenets through writing and participation in public debates. He also directed the policy of the anti-Trinitarian movement in Transylvania (now part of Rumania), largely through correspondence. Although he avoided identifying himself with any particular sect and denied that his beliefs were heretical, he suffered persecution and in 1598 was driven out of Kraków (now Cracow), Poland, by a hostile mob. Many of his theological views reflected the influence of Humanism (q.v.) in their emphasis on human reason and their repudiation of the supernatural.

See also CATECHISM.

SOCIOLOGY, one of the social sciences (q.v.), is concerned with the study of the organization of, and regularities in, societies and the units of which they are composed. It contrasts with such social sciences as economics and political science (qq.v.) in its concern with a wide range of social institutions rather than with a single in-



August Comte

Bettmann Archive

stitution; with psychology (q.v.) in its concern with the features of social units rather than with individuals; and with anthropology (q.v.) in its concern with complex societies or components thereof, rather than with small, relatively self-contained societies such as tribes. Although these contrasts are roughly characteristic, the several disciplines that make up the social sciences share many concepts and methods.

History. As a science or body of systematized knowledge, sociology is of relatively recent origin. The term "sociology" originated in 1837 with the French philosopher Auguste Comte (q.v.), who later used it to designate the general scientific principles that he believed were common to philosophy and history (qq.v.) and that he derived from a study of developments in those subjects in the preceding hundred years. Prior to Comte, the study of the origin, basis, structure, functions, and development of society had been regarded as the province of philosophy. Comte made this study a separate branch of knowledge.

Comte's innovation was taken up by the British philosopher Herbert Spencer (q.v.), whose *Principles of Sociology* (3 vol., 1876–96) had a marked influence on German, French, and American scholars. Another and ultimately more decisive factor in the development of sociology as a separate branch of science was the influence of the concept of evolution (q.v.) formu-

lated by the British naturalist Charles Robert Darwin (see under DARWIN), in his *The Origin of Species* (1859) and *The Descent of Man* (1871). The concept of the development of biological species in terms of natural selection was applied in the area of society; as scholars sought to establish principles and laws by which to explain the evolutionary development of social phenomena, they transformed existing studies into the social sciences enumerated above, with such special applications as criminology, penology, and social psychology (qq.v.).

The development of sociology as a distinct discipline is closely tied to the development of modern industrial capitalism out of feudalism (qq.v.) in Europe, and its growth in the United States. Much of the classical literature of sociology is concerned with that historical process, as in the writings of the German political philosopher Karl Marx, the German sociologist Max Weber (qq.v.), and the French sociologist Emile Durkheim (1858–1917). Attention was focused on the interrelationships of changes in the economic structure, political organization, kinship systems, normative (or moral) basis, characteristic interpersonal relationships, and other aspects of social organization. Sociologists further strove to characterize the dominant features of industrialization, capitalism, science, technological change, bureaucracy, democracy, extended family structures, and the transformation of community into mass society. In analyzing the causes, consequences, and interrelationships between these phenomena, they have sought to subject the historical transformations of the West to disciplined inquiry, and more recently have sought to describe possibly similar transformations in other parts of the world.

Problems for Sociology. The historical transformation of societies is one master problem for sociology—the problem of social change. Another master problem is concerned with the bases for social stability—the problem of social order. Although important exceptions occur, a concern with the problem of social change generally leads to an emphasis on conflict within society, and the economic and political power bases of such conflict as a major source of change in social organization. A concern with the problem of social order has generally involved an emphasis on common values, moral consensus, and shared social norms as the basis for the stability of societies. The former emphasis, on change, conflict, and problems of power and divergent interests is classically represented by Marx. The latter emphasis, on order and stability, and their source in the normative under-

pinnings of society, can be traced, in the modern period, to Durkheim, and is one basis for the so-called functionalist approach. This school of thought seeks to show how the various components of a social organism contribute to its maintenance and viability, through the functions by which they maintain its existence.

Methods of Study. Sociologists study units other than total societies, and they subdivide their discipline and label its parts. The size of the units they study may range from that of the individual, (inasmuch as his behavior or attitudes are socially organized or influenced) to two-person interaction, small groups, and families, to organizations (such as bureaucracies), crowds, and neighborhoods. The units studied may even include cities, institutions (thought of as the activities organized to accomplish some function in society), societies and multi-society units. Analytically, units of varying size may be studied in terms of such factors as normative structure, that is, the structure of rules and expectations defining and governing positions in a social structure; stratification, or hierarchical organization; patterns of group interest and conflict; population characteristics and recruitment; socialization practices; power and reward structures; and processes of change.

The range of theoretical concerns and topics of investigation in sociology is paralleled by a diversity of methods of investigation and types of data with which sociologists deal. These may include historical materials, such as governmental or church records, newspapers, diaries, and documents, as well as the accounts of professional historians. On the other hand, methods of investigation and data may be based upon demographic data, including information on births, deaths, and marriages, and statistics on the labor force, residential patterns, voting patterns, and criminal behavior; or sociologists may use interview surveys, from participant-observation or experimental research in the laboratory.

Recently a considerable increase has occurred in use of mathematical techniques for the analysis of many kinds of data in the hope of increasing the precision of sociological analysis and the scientific character of the discipline.

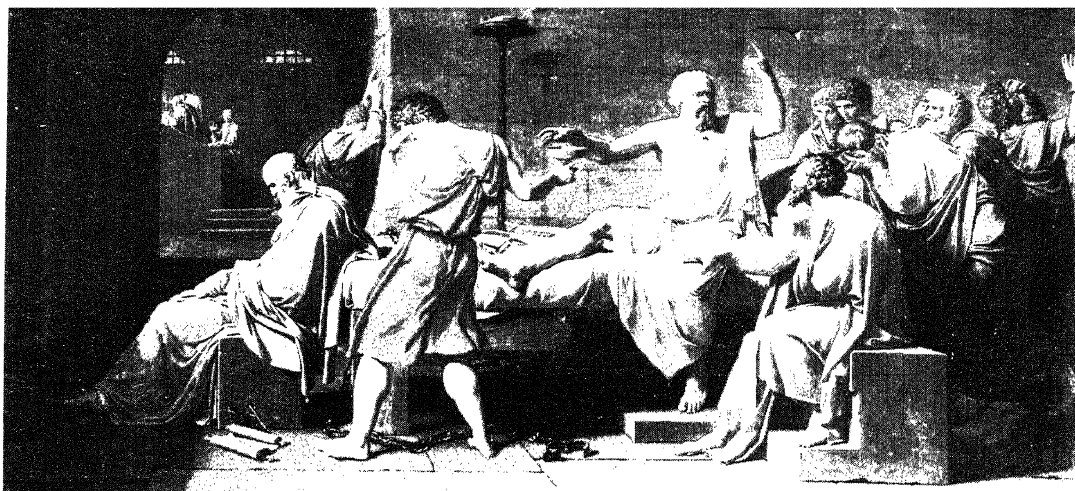
SOCKEYE. See SALMON.

SOCOTRA, or SOKOTRA, island in the Indian Ocean, belonging to the People's Democratic Republic of Yemen, at the entrance to the Gulf of Aden, about 147 miles E. of Cape Guardafui. The principal commercial products are ghee, aloes, and incense. The inhabitants keep extensive herds of goats and cows. Socotra shared the

history of South Arabia; from 1886 until the independence of Yemen in 1967 Socotra was under the protection of Great Britain. Area, 1382 sq.mi.; pop. (latest est.) 8000.

SOCRATES (470?-399 B.C.), Greek philosopher, born in Athens, the son of Sophroniscus, a sculptor, and of Phaenarete, a midwife. He received the regular elementary education in literature, music, and gymnastics, and later familiarized himself with the rhetoric and dialectics of the Sophists (q.v.), the speculations of the Ionian philosophers, and the general culture of Periclean Athens; see ATHENS; GREEK PHILOSOPHY: *The Ionian School*; PERICLES. Socrates followed at first the craft of his father, and, according to a former tradition, executed a statue group of the three Graces, which stood at the entrance to the Acropolis (q.v.) until the 2nd century A.D. In the Peloponnesian War with Sparta (q.v.) he served as an infantryman with conspicuous bravery at the battles of Potidaea in 432-430 B.C., Delium in 424 B.C., and Amphipolis in 422 B.C.; see GREECE: *History: Ancient Greece: Hellenic Period*. Socrates believed in the superiority of argument over writing and therefore spent the greater part of his mature life in the market place and public resorts of Athens in dialogue and argument with anyone who would listen, or would submit himself to his interrogation. Socrates was unattractive in appearance and short of stature, but was also extremely hardy and self-controlled. He enjoyed life immensely and achieved social popularity because of his ready wit and a keen sense of humor that was completely devoid of satire or cynicism.

Attitude Toward Politics. Socrates was obedient to the laws of Athens, but generally held aloof from politics, restrained by what he believed to be divine warning. He considered that he had received a call to the pursuit of philosophy and could serve his country best by devoting himself to teaching, and by persuading the Athenians to engage in self-examination, and in tending to their souls. He wrote no books and established no regular school of philosophy. All that is known with certainty about his personality and his way of thinking is derived from the works of two of his distinguished scholars: the philosopher Plato (q.v.), who at times ascribes his own views to his master, and the historian Xenophon (q.v.), a rather prosaic writer, who probably failed to understand many of Socrates' doctrines. Plato represents Socrates as hiding behind an ironical profession of ignorance, known as Socratic irony, a mental acuity and resourcefulness that enabled him to penetrate arguments with great facility.



"The Death of Socrates", painting by the 18th-century French artist Jacques Louis David.

Metropolitan Museum of Art

Teachings. Socrates' contribution to philosophy was essentially ethical in character. Belief in a purely objective understanding of such concepts as justice, love, and virtue, and the self-knowledge which he inculcated, were the basis of his teachings. He believed that all vice was the result of ignorance, and that no man was willingly bad; correspondingly, virtue was knowledge, and the man who knew the right would act rightly. His logic (q.v.) placed particular emphasis on rational argument and the quest for general definitions as evidenced in the writings of his younger contemporary and pupil Plato, and of Plato's pupil Aristotle (q.v.). Through the writings of these philosophers Socrates profoundly affected the entire subsequent course of Western speculative thought. Another thinker befriended and influenced by Socrates was Antisthenes (q.v.), the founder of the Cynic school of philosophy; see CYNICS. Socrates was also the teacher of Aristippus (435?–?356), who founded the Cyrenaic philosophy of experience and pleasure (see CYRENAICS), from which developed the more lofty philosophy of Epicurus (q.v.). The ideal Socrates, depicted in Plato's *Apology*, *Crito*, *Gorgias*, and *Phaedo*, became, as the influence of the ancient Greek and Roman divinities waned, the chief religious type of the ancient world. To such Stoic philosophers and moralists as the Greek philosopher Epicuretus, and the Romans Marcus or Lucius Annaeus Seneca, and the emperor Marcus Aurelius (qq.v.), he appeared as the very embodiment and guide of the higher life; see STOICISM.

The Trial. Although a loyal patriot and a man of deep religious conviction, Socrates was nonetheless regarded with suspicion by many of his contemporaries, who disliked his attitude toward the Athenian state and the established

religion. He was charged in 399 B.C. with neglecting the gods of the state and introducing new divinities, a reference to the daemonion, or mystical inner voice, to which Socrates often referred. He was also charged with corrupting the morals of the young, leading them away from the principles of democracy (q.v.); and he was wrongly identified with the Sophists, possibly because he had been ridiculed by the comic poet Aristophanes (q.v.) in the *Clouds* as the master of a "thinking-shop" where young men were taught to make the worse appear the better reason. Plato's *Apology* gives the substance of the defense made by Socrates at his trial; it was a bold vindication of his whole life. He was condemned to die, although the vote was carried only by a small majority. When, according to Athenian legal practice, Socrates made an ironic counter-proposition to the court's death sentence, proposing only to pay a very small fine because of his value to the state as a man with a philosophic mission, this offer so angered the jury that it voted by an increased majority for the death penalty. Socrates' friends planned his escape from prison, but he preferred to obey the law and die for his cause. His last day was spent with his friends and admirers, as described in Plato's *Phaedo*, and in the evening he calmly fulfilled his sentence by drinking a cup of hemlock according to a customary procedure of execution. He was married to Xanthippe (q.v.), a reputedly shrewish woman, and had three children. See GREEK PHILOSOPHY: *Socrates*; *Plato*; *Aristotle*; *Hellenistic Philosophers*; PHILOSOPHY: *Greek Philosophy*; *Hellenistic and Roman Philosophy*.

SODA, term applied to various compounds of sodium, and particularly to sodium carbonate, Na_2CO_3 , and to sodium bicarbonate, NaHCO_3 . Sodium carbonate, sp.gr. 2.53, m.p. 851°C . (1563.8°F .), is a white powder with strong alkaline properties, and occurs in nature dissolved

in the waters of inland lakes called soda lakes. It occurs also in some salt beds. Several hydrated forms of sodium carbonate are manufactured, chief among which are the decahydrate, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, called washing soda or sal soda, and the monohydrate, $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$, called crystal carbonate.

Sodium carbonate was originally prepared from the ashes of seaweed and was called soda ash, but was not used on a large scale until the French chemist Nicolas Leblanc (1742–1806) devised a method, called the Leblanc process, for the production of the compound from ordinary table salt, sodium chloride. The Leblanc process was superseded by the less expensive Solvay process, invented by the Belgian chemist Ernest Solvay (q.v.), in an attempt to utilize the ammonia obtained as a by-product in the coke industry. In the Solvay process sodium chloride is treated with ammonia gas and then with carbon dioxide, resulting in the formation of sodium bicarbonate, NaHCO_3 , and ammonium chloride. The sodium bicarbonate precipitate is filtered from the solution of ammonium chloride and is dried and heated to form sodium carbonate. Approximately 4,000,000 tons of sodium carbonate are produced in the United States annually by the Solvay process, and 3,000,000 tons are recovered from natural deposits. The compound is used in the manufacture of glass and ceramics, in the pulping of wood to make paper, and in the manufacture of soap. It is also used in petroleum refining, as a water softener, as a cleaner and degreaser in washing compounds, and in the manufacture of other sodium-containing compounds, such as sodium hydroxide.

Sodium bicarbonate, or baking soda, is a white powder with sp.gr. 2.16. It decomposes when heated in air above 55°C . (131°F .), losing carbon dioxide and water and forming sodium carbonate. It is an important constituent of baking powder and is also employed as a source of carbon dioxide in fire extinguishers. It is used medicinally to neutralize excess acid in the stomach and is used industrially to moderate the alkalinity of sodium carbonate. It occurs naturally in many mineral springs and is manufactured by treating sodium carbonate with water and carbon dioxide, or as an intermediary in the Solvay process. For other compounds of sodium, which are designated as soda with a qualifying term, see ALKALIES; SODIUM.

SODDY, Frederick (1877–1956), British chemist, born in Eastbourne, England, and educated at Eastbourne College, University College of Wales, and the University of Oxford. He was a lecturer in physical chemistry and radioactivity

at the University of Glasgow from 1904 to 1914 and professor of chemistry at Oxford from 1919 to 1936, at which time he retired from academic life. With the British physicist Ernest Rutherford (q.v.) he began investigating radioactive transformations of atomic nuclei and eventually developed a theory of atomic structure. Soddy is particularly known for his investigations of the origin and nature of isotopes (see ISOTOPE), for which he was awarded the 1921 Nobel Prize in chemistry. His writings include such classic scientific works as *Radioactivity* (1904), *Matter and Energy* (1912), *Interpretation of the Atom* (1932), *The Story of Atomic Energy* (1949), and *Atomic Transmutation* (1953), and works of a political-economic nature, including *Cartesian Economics* (1922), *Role of Money* (1934), and *British Budget* (1938).

SÖDERBLOM, Nathan (1866–1931), Swedish Lutheran archbishop, theologian, and historian, born in Trönö, and educated at the University of Uppsala, and the Sorbonne in Paris. In 1914 he became archbishop of Uppsala and prochancellor of the University of Uppsala. An advocate of peace and the unity of Christian Churches, in 1925 he organized in Stockholm, Sweden, the Christian Conference on Life and Work, in an attempt to promote universal peace. For this and his efforts to aid war prisoners and displaced persons during World War I, he was awarded the 1930 Nobel Peace Prize. His principal works included *The Religions of the World* (1905); *Introduction to the History of Religion* (1920), and *Christian Fellowship* (1923).

SODIUM, metallic element, member of the alkali group of metals, with at.no. 11, at.wt. 22.9898, b.p. 883.0°C . (1621.4°F .), m.p. 97.83°C . (208.09°F .), sp.gr. 0.971^{20} , and symbol Na. It was discovered in 1807 by the British chemist Sir Humphry Davy (q.v.). Sodium is found in nature only in the combined state. It occurs in the ocean and in salt lakes as sodium chloride, NaCl , and less often as sodium carbonate, Na_2CO_3 , and sodium sulfate, Na_2SO_4 , and ranks sixth in order of abundance of all the elements in the crust of the earth. It is a necessary constituent of plant and animal tissue.

Elemental sodium is a highly reactive, silvery-white metal that is soft enough to be cut with a knife. It has a hardness of 0.4. It oxidizes immediately upon exposure to air and reacts violently with water, forming sodium hydroxide and hydrogen. It is prepared commercially by the electrolytic decomposition of fused sodium chloride. The element is used in the manufacture of tetraethyl lead and as a cooling agent in nuclear reactors; see NUCLEAR POWER: *Breeder Reactors*.

SODIUM BENZOATE

The most important compound of sodium is sodium chloride, known commonly as salt (q.v.). Other important compounds include sodium carbonate, known as washing soda, and sodium bicarbonate, known as baking soda; see SODA. Sodium hydroxide, known commercially as soda lye or caustic soda, is used in the manufacture of soap, rayon, and paper, in oil refining, and in the textile and rubber industries. Sodium borate is known commonly as borax (q.v.). Sodium fluoride, NaF, is used as an antiseptic, as a poison for mice and roaches, and in ceramics. Sodium nitrate, known as Chile saltpeter, is used in fertilizer (q.v.); see SALTPETER. Sodium peroxide, Na_2O_2 , is an important bleaching and oxidizing agent. Sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$, known as hypo, is used in photography (q.v.) as a fixing agent. S.Z.L.

SODIUM BENZOATE, or BENZOATE OF SODA, white crystalline or granular sodium salt of benzoic acid of formula $\text{C}_6\text{H}_5\text{COONa}$. It is soluble in water and slightly soluble in alcohol. The salt is antiseptic, and is commonly used as a preservative in foods. In large quantities it is toxic, and Federal law prohibits the use of more than 0.1 percent of the salt in foods. It is used medicinally in making a test of liver function. S.Z.L.

SODIUM BICARBONATE. See CARBONATES; SODA.

SODIUM CHLORIDE. See SALT; SODIUM.

SODIUM NITRATE. See NITRATES; SODIUM.

SODOM AND GOMORRAH, according to the Old Testament (notably Gen. 18, 19), two ancient cities near the Dead Sea. The Bible almost invariably speaks of them together. With Admah, Zeboim, and Zoar, they formed the five "cities of the plain", all but the last-named of which are said to have been destroyed by a rain

of brimstone, perhaps accompanied by an earthquake, because of the wickedness of their inhabitants. Some evidence indicates that they did exist, were destroyed, and that their sites now lie under the Dead Sea. The Biblical story of the destruction of the cities is considered by many critics similar to tales found among the Arabs (and other nations) regarding the sudden disappearance of places, and, indeed, Lot (q.v.), who in the Biblical story survives the destruction, figures prominently in the Koran (q.v.). Those who deny the literal truthfulness of the narrative contend that the weird character of the land around the Dead Sea, which is fatal to plant and animal life, would naturally suggest the thought of some catastrophe. Jesus Christ said that on the Day of Judgment God would be more severe with cities rejecting the Gospel (q.v.) than he had been with Sodom and Gomorrah (Matt. 10:15, 11:20–24). See also ESCHATOLOGY.

SOERABAJA. See SURABAJA.

SOFIA, (Bulg. *Sofiya*; anc. *Sardica* or *Serdica*), city and capital of Bulgaria, in Sofia Province, on an elevated plain at the foot of the Balkan Mts., about 80 miles N.W. of Plovdiv. Sofia is one of the principal railroad terminals of the Balkan Peninsula, and is the commercial and financial center of Bulgaria. The principal industries include the manufacture of machinery, iron and steel, chemicals, and textiles. The Chapel of Saint George, once a Roman bath, is the oldest structure in Sofia. Other notable structures include the ruins of the 6th-century Church of Saint Sofia, which was used as a mosque, and the 19th-century Cathedral of Alexander Nevski. The city is also the site of the Bulgarian Academy of Sciences (1869) and the University of Sofia (1888).

Sofia was founded in the early 2nd century A.D. by the Roman emperor Trajan (q.v.) as Sardica or Serdica. Sardica was plundered and burned by the Huns in the 5th century, and in 809 it was taken by the Bulgarians, who changed the name to Sredetz. In the 14th century the town was captured by the Ottoman Turks. About this time the name, Sofia, taken from the 6th-century church, came into use. When Bulgaria became independent of the Turks in 1878, Sofia was chosen as the national capital. Pop. (1970 U.N. est.) 876,943.

SOFTBALL, form of the game of baseball (q.v.), played with a special ball. The rules for softball are generally similar to those for baseball, with the following essential differences. (1) Softball may be played indoors as well as outdoors and is extensively played by teams of women as well

The National Assembly Hall in Sofia.

Bulgarian Trade Mission



as of men. It has two major divisions, fast-pitch softball and slow-pitch softball. (2) The ball used in softball is larger and somewhat softer than that employed in baseball. It is made of kapok (see CEIBA) wrapped with yarn and enclosed within a leather cover with smoothly sewn seams. The ball is between $11\frac{1}{4}$ and $12\frac{1}{4}$ in. in circumference and weighs between 6 and $6\frac{3}{4}$ oz. A special 14-in. ball for slow-pitch softball is seldom used, but a 16-in. ball is still used in certain limited tourneys. The bat used in softball may not be more than 34 in. long. (3) Infield measurements are less than those in baseball. In softball the distance between bases is 55 ft. The distance between the pitcher's box and home plate is 46 ft. in games played by men and 40 ft. in games played by women. Pitching, in softball, is underhand only, being very swift in the fast-pitch game. In slow-pitch softball, the ball is thrown more gently and must be arched. (4) Until 1946 a softball team consisted of ten players, including the nine that make up a baseball team plus an extra outfielder called a short-fielder. The ten-man side is still used in slow-pitch softball, but nine players is the rule for the fast-pitch game today. (5) In slow-pitch softball, neither bunting nor base stealing is allowed.

Softball was invented at about the beginning of the 20th century by American professional baseball players who desired to keep in practice during the late fall and winter months, when the playing of baseball is impossible in most parts of the United States; the substitute game was played indoors. Toward the end of the second decade of the century Canadian amateur players began to play the new game outdoors, on playgrounds or other suitable fields; the game then rapidly gained popularity in Canada and obtained a foothold in the U.S. Extensive interest in softball began in the U.S. about 1930. The first national amateur softball tournament took place in Chicago, Ill., in 1933, in connection with the world's fair then being held in that city. When fast pitching began to dominate the game after about twenty years, slow-pitch softball was developed in order to give batters a better chance. The popularity of the game spread abroad, especially in Mexico, Cuba, Japan, and Australia.

In 1933, also, the Amateur Softball Association was founded to standardize the rules and govern the sport in other particulars; the association is still the governing body for softball in the U.S. Under its auspices annual sectional tournaments, both fast-pitch and slow-pitch softball, are held throughout the U.S. for both men and women. The winners of these tournaments and the championship team of the previous year

meet in national championship tourneys. The first world softball championship was played in 1966. About 25,000,000 Americans play softball, making it the nation's leading participation sport; internationally, about 36,000,000 people take an active part in the game.

SOGNEFJORDEN, long and narrow indentation on the coast of Norway, extending inland for a distance of 110 mi. It is the longest fjord in Norway and is in the midst of rugged and magnificent scenery. Mountains rise from it to a height of more than 5000 ft., and in parts it is more than 4000 ft. deep. The mouth is about 45 miles N. of Bergen.

SOHÂG, city and port in the Arab Republic of Egypt, and capital of Sohâg Governorate, on the Nile R. at the southern end of the Bahr Sohag-uieh (canal), 190 miles N.W. of Aswân. The city trades in cotton, grains, dates, and sugar, and has cotton-ginning, dairying, and pottery-making industries. The ruins of a 5th-century Coptic church are in Sohâg. To the E. is Akhmîm, the ancient Panopolis or Khemmis, and to the S.W., at the edge of the desert, are the ruins of the ancient Athribis. The governorate was formerly called Girga. The name of the city and governorate is sometimes spelled Suhag, Souhag, or Suhaj. Pop. (1971 est.) 83,800.

SOILS AND SOIL MANAGEMENT, superficial covering of most of the land area of the earth is an aggregation of unconsolidated mineral and organic particles produced by the combined action of wind, water, and organic decay. Soils vary widely from place to place. The chemical composition and physical structure of the soil at any given location are determined by the kind of geologic material from which it originates, by the vegetation cover, by the length of time that the soil has been weathered, by the topography, and by artificial changes caused by man's activities. In nature, changes in soil are gradual, except those resulting from natural disasters. The cultivation of land, however, deprives soil of its natural vegetational covering and of much of its protection against erosion by water and wind, permitting more rapid changes. Agriculturists have found it necessary to develop methods of preventing harmful alteration of soil resulting from cultivation and of rebuilding soil already detrimentally altered.

Although knowledge of the gross texture of soil is important to engineers who construct buildings, roads, and other structures on the surface of the earth, all the specific properties of soil are of great concern to agriculturists, to whom knowledge of the mineral and organic components of soils, aeration and water-hold-

SOILS AND SOIL MANAGEMENT

ing capacity, as well as many other aspects of soil structure necessary for successful crops. The soil requirements of different plants vary widely, and no generalizations can be made concerning an ideal soil for the growth of all plants. Many plants, such as sugarcane, require moist soils which would be deemed poorly drained by wheatgrowers. Characteristics suitable to successful growth of crops are not necessarily inherent in the soil itself; some of these characteristics are created by successful management of the soil (see *Soil Management*, below).

Nature of Soil. The primary components of soil are (1) undissolved inorganic or nonliving components produced by the weathering and breakdown of surface rocks; (2) soluble nutrients used by plants; (3) various forms of organic matter, both living and dead; and (4) the gases and water required by plants and subterranean organisms.

The physical nature of the soil is determined by the proportions of particles of various sizes. Inorganic particles in soil range in size from fairly large pieces of stone and gravel to extremely small particles less than 1/100,000 in. in breadth. Large soil particles, such as sand and gravel, are largely inactive chemically, but small inorganic particles, the chief components of fine clays, serve also as a reservoir from which nutrients are drawn by plant roots. The size and nature of these tiny inorganic particles also determine to a large measure the ability of a given soil to store water, which is vital to all plant growth processes.

The organic fraction of soil is composed of undecayed plant and animal debris, together with variable amounts of an amorphous organic material called humus (q.v.). The organic fraction comprises 2 to 5 percent of the surface soil for many soils in humid regions, but may be less than 0.5 percent in arid soils or more than 95 percent in peat soils.

The liquid component of soils, called by scientists the soil solution, is largely water containing a number of mineral substances in solution, as well as comparatively large amounts of dissolved oxygen and carbon dioxide. The soil solution is highly complex and is not well understood scientifically; it is of primary importance as the medium through which nutrient materials reach and are absorbed by the roots of plants. When the soil solution is defective in one or more of the nutrient elements needed for plant growth, the soil is infertile.

The gases contained in soil are chiefly oxygen, nitrogen, and carbon dioxide. The first of these

gases is important for plant metabolism because its presence is necessary for the growth of the various soil bacteria and other organisms causing the decomposition of organic materials. The presence of oxygen is also vital for plant growth in that its absorption by the roots of plants is necessary to their metabolic processes.

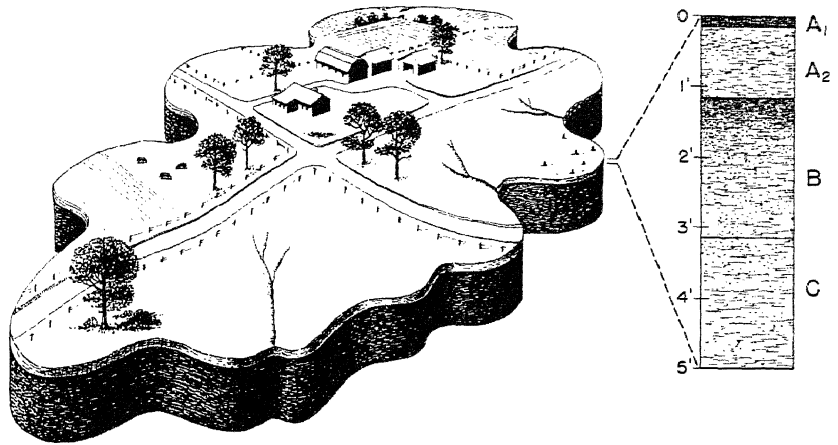
Types of Soils. Soils exhibit marked variation in appearance, fertility, and chemical characteristics depending on the mineral and plant materials from which they have been formed. Color is one of the simplest criteria for judging varieties of soil. The general but not invariable rule is that dark soils are more fertile than soils of lighter color. Darkness in soil color usually results from the presence of a large amount of humus (q.v.) in the soil. In some cases, however, soils that are dark brown or black in color owe their hue to mineral materials or to excessive dampness; in such cases, dark color is not an index to fertility. Soils having a red or reddish-brown hue usually contain a large proportion of iron oxides (derived from the parent rocks) which have not been subjected to excessive humidity. Red color in a soil, therefore, is generally an indication that the soil is well-drained, not excessively humid, and fertile. This generalization is particularly true in the southeastern United States but is not always true in other parts of the world, where a reddish color in the soil may be the result of freshly formed mineral materials not chemically available for plant use. Almost all yellow or yellowish soils are low in fertility. They owe their color to iron oxides that have reacted chemically with water and are thus a sign of poorly drained land or which has been poorly drained in the past. Grayish soils may be deficient in iron or oxygen or may have an excess of alkaline salts such as calcium carbonate.

The general texture of a soil depends upon the proportions of particles of various sizes of which it is constituted. Soil particles are arbitrarily divided into sand, silt, and clay. Particles of sand range in size from 2 to .05 mm. in diameter; those of silt from .05 to .002 mm.; and those of clay smaller than .002 mm. In general, sand particles can easily be seen by the naked eye and feel pronouncedly rough or gritty to the touch. Silt particles can scarcely be seen without the aid of a microscope and feel like flour when rubbed through the fingers. Clay particles are invisible to the naked eye and form a gummy mass when wet.

According to the proportions of sand, silt, and clay, soils are broadly classified into several arbitrarily defined textural groups, including sandy clay, silty clay, clay loam, sandy clay loam, silty

Sketch showing a single area of a soil type as it occurs in nature (left), and a cross section of the layers, or horizons. The nature, number, thickness, and arrangement of the horizons are important in the identification and classification of soils.

Soil Conservation Service



clay loam, sandy loam, silt loam, and loamy sand. The texture of a soil has great effect upon its productivity. Soils with a high percentage of sand are usually incapable of storing sufficient water to give the best plant growth and lose large amounts of plant-nutrient minerals by leaching to the subsoil. Soils containing a larger percentage of finer particles, for example the clays and loams, are excellent reservoirs for water and contain readily available mineral materials. Heavy clay soils composed largely of clay particles, however, tend to contain a water excess; these soils have a gummy texture rendering them resistant to cultivation and frequently inadequately aerated for normal plant growth.

Soil Classification. Soils are organized into classes according to their general characteristics. The soil classification system now in use in the U.S. is based on the morphology and composition of soil, emphasizing those properties that can be seen, felt, or measured, for example its depth, color, texture, structure, and chemical composition. Most soils have characteristic layers, or horizons; the nature, number, thickness, and arrangement of these horizons are also important in the identification and classification of soils.

The properties of a soil reflect the interaction of several soil-forming processes that proceed simultaneously after the parent material has accumulated. Some substances are added to the soil, others are removed. The transfer of materials from one horizon to another is common. Some materials are transformed into different forms. All these processes go on at various rates and in different directions resulting in soils with different kinds of horizons or different appearances within the same kind of horizon.

Soils that share many common characteristics

are grouped into series. Closely related series are combined into families. In the same way, families are combined into groups, great groups into suborders, and suborders into orders. Ten orders exist in the U.S., which include about 9000 soil series.

The names of the orders, suborders, great groups, and subgroups are coined terms based mainly on Greek and Latin roots. Each name is designed to indicate the relationship of a class to the other categories and to connote a few of the soil characteristics in the grouping.

Entisols are soils that lack both well-developed horizons and the characteristics of vertisols and oxisols (see below).

Vertisols contain a large amount of a type of clay that shrinks and swells with changes in its moisture content and that consequently exhibits a very slow churning action. Vertisols are identified by wide cracks when dry; slick-sided, wedge-shaped structural units, and very irregular microrelief.

Inceptisols have weakly expressed horizons and lack both a significant accumulation of clay in the subsoil (B horizon) and extreme weathering. Inceptisols occur in areas that receive sufficient rainfall in most years to cause some leaching.

Aridisols occur in dry regions. The surface soil is low in organic matter, and leaching has been insufficient to remove soluble materials such as lime, gypsum, and salt.

Mollisols form in subhumid to semiarid regions where the precipitation is sufficient to produce large amounts of organic matter but insufficient, in many cases, to leach the bases (calcium, magnesium, potassium, and sodium). Mollisols have thick, dark-colored surface horizons and are relatively high in calcium. They usually develop under grass vegetation. These

SOILS AND SOIL MANAGEMENT

are the most important grain-producing soils in the world.

Spodosols occur in humid regions, usually under forest vegetation. The main identifying characteristic is the horizon of precipitated organic matter, aluminum, and, in some instances, iron.

Alfisols are usually moist, have a B horizon with clay accumulation, medium or high base status, and light-colored surface layers. They are similar to mollisols in many respects but lack a thick, dark-colored surface layer.

Ultisols also have a B horizon with clay accumulation but are low in bases. Ultisols occur in regions where the rainfall is high in one or more seasons of the year but limited in other seasons. As a general rule, ultisols are low in lime and plant nutrients.

Oxisols are highly weathered soils in tropical or subtropical areas. They have a subsurface horizon high in aluminum, iron oxides, and non-swelling clays, but they are low in cation exchange capacity. Oxisols require special management if they are to be cultivated successfully.

Histosols exist in very wet areas such as bogs and marshes and are composed mainly of plant tissues in various stages of decomposition.

Soils in many parts of the world are being classified and mapped according to their characteristics. Published soil surveys containing detailed soil maps are available for many counties in the U.S. Soil maps for individual farms are useful as guides to sound soil management.

Soil Chemistry. Soil has been likened to an extremely elaborate chemical laboratory in which a large number of reactions, involving almost every known element, take place. Certain reactions are comparatively simple and are well understood, but the vast majority of them are extremely complex and are not completely understood by soil scientists. In general, soils are composed primarily of silicates, ranging in complexity from the simple oxide of silicon, quartz, to the highly complex hydrated aluminum silicates found in the soil clays; see SILICON. The elements obtained from the soil most important to plant nutrition are phosphorus, sulfur, nitrogen, calcium, iron, and magnesium. Recent research has shown that plants also need small but significant quantities of such elements as boron, copper, manganese, and zinc in order to flourish.

Plants obtain nutrients from the so-called soil colloids, extremely minute, claylike particles of soil. The colloids have been formed as the product of physical and chemical weathering of primary minerals. Soil colloids consist of varying

amounts of hydrated oxides of iron, aluminum, and silicon and such crystalline secondary minerals as kaolinite and montmorillonite.

Colloids have certain pronounced physical characteristics strongly affecting the agricultural characteristics of different soils. Soils from regions which have only moderate rainfall and comparatively little ground water are subjected to only moderate leaching and, as a result, contain a large amount of their original components, such as calcium, potassium, and sodium. Colloids of this type expand to a large degree when wet and tend to disperse in water. They also dry to a jellylike consistency after being wet, and may, on further drying, form masses that are completely impervious to water. In many portions of the western U.S. the soil colloids are of this nature, producing soils which cannot be irrigated unless the colloids are first leached free of their exchangeable sodium. In portions of the eastern U.S. where the ground was formerly covered by forests, inorganic and organic colloids are carried downward through the soil with the ground water after rains or flooding forming a concentrated layer in the lower part of the soil, cementing the other soil particles to produce a dense, solid hardpan.

One of the important characteristics of colloidal soil particles is the ability to take part in a form of chemical reaction known as base exchange. In this reaction a compound is changed by the substitution of another chemical element for one of its constituents. Thus, elements formerly bound to the colloid compound may become free and available as plant nutrients in the soil solution. When such fertilizing materials as potassium are added to soil, a portion of the required element becomes immediately available as part of the soil solution, while the rest takes part in a base exchange and remains in the soil incorporated in the soil colloids. One of the simplest and most agriculturally valuable examples of base exchange is the reaction that occurs when limestone (CaCO_3) is used to neutralize acidity. Soil acidity, which can be defined as the concentration of hydrogen ions, affects the health of most plants; legumes, for example, cannot grow on acid soil.

Soil Water. As indicated above, the amount of available water in a given soil has a profound effect upon the productivity of the soil for agricultural use. In both the vapor and the liquid states, water occupies about one fourth of the volume of a productive soil. The amount of water retained depends on the size and arrangement of the soil pores. In coarse and loose soils, water tends to drain away by gravity, leaving a

small residue. Fine-textured soils usually have a greater total porosity, and thus retain larger amounts of water than do coarse-textured soils. Water moves and is retained for soil use within this pore system. Only about two thirds of the water retained by the soil after the excess has been drained away by gravity is available for plant use. The remaining water is held by the soil particles with sufficient strength to prevent its removal by plants. The forces acting on soil water, called soil suction, can be classified as those caused by the soil particles (matric forces), those caused by the solutes dissolved in the water (osmotic forces), and those caused by gravity (gravitational forces). Matric forces arise from capillary action and electrostatic interactions between the water and the soil particles. Osmotic forces depend on the amount of dissolved salts in the water indirectly affecting the movement of water through the soil. The sum of the matric and osmotic forces is called the total water potential.

Water that interacts with the surfaces of soil minerals has different properties from free water. As a result, it has been called bound water. Bound water reportedly has a higher specific volume, viscosity, and specific heat, a lower dielectric constant, and a greater resistance to molecular rearrangement than free water. These effects extend for very short distances, on the order of three to ten molecular water layers. Hydrogen bonding and Van der Waals forces (of intermolecular attraction) are cited as the reasons for the bonding of water to soil surfaces.

The water requirements of plants are met by water in the soil. The upper limit of the reservoir depends on the field capacity of the soil, and the lower limit depends on the permanent wilting percentage of the soil and also on the effective root zone of the crop. Field capacity is the amount of water in a soil two or three days after a thorough wetting of its profile, expressed in terms of the dry weight of the soil. Permanent wilting percentage is the percentage of water in soil at which plants wilt and remain wilted when placed in a moist atmosphere.

Organic Soil Materials. The general term for the complex mixture of organic materials in soil is humus. Humus is not a stable mixture of chemicals but is rather a dynamic, constantly changing mixture representing every stage in the decay of dead organic matter from the simplest to the most complex. The decay process is caused by the action of large numbers of microscopic bacteria and fungi. These microorganisms, in the course of feeding, attack and digest

the complex organic compounds which make up living matter and reduce them to simpler compounds that plants can utilize for food. A typical example of bacterial action is the formation of ammonia from animal and vegetable proteins. Other bacteria oxidize the ammonia to form nitrites and still other bacteria act on the nitrites to form nitrates, a type of nitrogen compound which can be utilized by plants. Some types of bacteria are able to fix or extract nitrogen from the air and make it available in the soil; see NITROGEN FIXATION. Even the parts of humus which have not been decomposed or which have undergone only incomplete decomposition contribute to soil fertility by making the soil mixture lighter and more porous.

Under natural conditions, as in areas that have never been disturbed by human tillage or deforestation, a balance exists between the amount of humus that is destroyed by ultimate decomposition and the amount that is added by the decay of plant and animal bodies. Wherever agriculture is practiced or where the equilibrium of natural processes is upset, either by man or by such natural accidents as fires, the balance is lost and a reduction in organic content of the soil occurs until a new equilibrium is attained. Practices used to maintain the content of soil organic matter at productive levels under different systems of cropping are described below.

SOIL MANAGEMENT

Soil management, the basis of all scientific agriculture, involves six general problems: proper tillage; maintenance of a proper supply of organic matter in the soil; maintenance of a proper nutrient supply; control of soil pollution; maintenance of the correct soil acidity; and control of erosion (q.v.).

Tillage. The purpose of tillage is to prepare the soil for the sowing of crops. This preparation includes removal or killing of any native vegetation growing in the area to be cultivated, loosening or breaking up the surface layers of the soil, and providing a bed of soil that holds sufficient moisture to permit the seeds planted in it to germinate. Primary tillage is usually followed by cultivation, which uproots or otherwise displaces remaining and newly sprouted weeds.

The chief mechanical implement used for tillage in all parts of the world is the plow. Plows may be designed for a number of purposes ranging from the simple cutting of a furrow through the ground to the complete reversal or turning over of soil, usually to a depth of 6 to 8 in. In certain areas and for certain purposes the plow is replaced as a primary tillage instrument by various types of harrows, the tools that

SOILS AND SOIL MANAGEMENT

scrape or scarify the surface of the ground without digging deeply into it. In most areas such implements are employed merely to break up and pulverize the soil after plowing. Harrows or tools of the same general design are almost universally used for cultivation or the tillage of ground between rows of growing crops.

Deep plowing and subsequent harrowing are necessary in areas where the soil is compact and impermeable to water and plant roots. Excessive tillage may result in the deterioration of soil structure, particularly if performed in wet soil. This problem is more acute in finely textured soils than in sandy and loamy soils, which normally require less tillage. Climate also plays its part in determining not only the amount but also the time of tillage. In humid areas, tillage should be limited to times when no great amount of rainfall is expected, for newly tilled fields are particularly subject to water erosion. In arid or subhumid areas, on the contrary, land should be tilled before periods of anticipated rainfall so that the ground can absorb the maximum amount of water.

Among the secondary but important benefits of tillage is the aeration resulting from pulverization. This aeration not only provides a freer circulation of oxygen and water but also results in increased biological activity in the soil, including that of organisms which fix atmospheric nitrogen. Tillage contributes to the health of plants by inhibiting plant diseases and by discouraging the development of various types of insects which are inimical to plant growth.

The type of tillage employed has a decisive effect on the loss of soil through erosion by wind and water. When furrows are plowed in an up-and-downhill direction, water tends to flow down the furrows, carrying away small particles of the top layers of soil as it flows. By plowing across the slope so that each individual furrow is level, the water is retained in the furrows and sinks into the soil rather than running off. Tillage of this type is commonly known as contour plowing because the furrows follow the natural contours of the land.

The kind and amount of cultivation or tillage between the rows of growing crops is determined essentially by the character of the soil. Heavy, waterlogged soil benefits by the stirring up and aeration which cultivation provides. On the other hand, hard, caked soils may require cultivation to permit them to absorb the moisture which the crops need. For soils, however, that are in good physical condition the primary purpose of cultivation of row crops is to permit easier weed control.

Maintenance of Organic Matter. Organic matter is important in maintaining good physical conditions in the soil. It contains the entire soil reserve of nitrogen and significant amounts of other nutrients, such as phosphorus and sulfur. Soil productivity thus is affected markedly by the organic-matter balance maintained in the soil. Because most of the cultivated vegetation is removed from the soil instead of being left to decay, organic materials that would ordinarily enter the soil upon plant decomposition are lost. To compensate for this loss, various standardized methods are employed. The two most important of these methods are crop rotation and artificial fertilization.

Crop rotation consists of growing different crops in succession on the same land, rather than utilizing a one-crop system or a haphazard change of crops. In the rotation system, crops are alternated on the basis of the amounts and types of organic matter that each crop returns to the soil. Because frequent tillage hastens the oxidative loss of organic matter, rotations usually include one or more sod crops that require little or no tillage. Deep-root penetration on the part of certain leguminous crops, such as alfalfa, provides better drainage as a result of the channels left after the roots decay.

The rotation system employs special types of crops such as cover crops and green manure. Cover crops are those crops planted to protect the soil in the winter, and, if a leguminous crop is used, to fix nitrogen in the soil. Green-manure crops are grown solely to be plowed under, and serve to increase the organic-matter content of the soil. Although no yield is expected of a green-manure crop, it is supposed to increase the yield of subsequent crops planted in the same fields.

The older method of increasing the organic content of the soil is the use of such fertilizers as manure and compost. The manuring of soil with animal wastes has been practiced for many thousands of years, and serves as a source of various complex organic compounds which are important in the growth of plants. Compost, which usually consists of mixtures of dead vegetable and animal matter, has a purpose similar to that of manure, and is often treated with chemical fertilizers to increase its effectiveness. For a discussion of the various types of fertilizing materials, see FERTILIZER. See also SEWAGE DISPOSAL: *Wastewater Treatment*.

Nutrient Supply. Among soil deficiencies that affect productiveness, deficiency of nutrients is especially important. The nutrients most necessary for proper plant growth are nitrogen, potas-



sium, phosphorus, iron, calcium, sulfur, and magnesium, all of which usually exist in most soils in varying quantities. In addition, most plants require minute amounts of substances known as trace elements (q.v.) present in the soil in very small quantities, and which include manganese, zinc, copper, and boron. Nutrients often occur in the soil in compounds that cannot be readily utilized by plants. For example, phosphorus combined with calcium or magnesium is readily utilizable, but phosphorus combined with iron or aluminum is usually unavailable to plants. The supply of utilizable minerals in soil is often increased by enrichment with artificial fertilizers and by treatments hastening the breakdown of complex compounds. The supply of available phosphorus, for example, is often increased by the addition of superphosphate fertilizers. Adding calcium to soils also decreases soil acidity and makes phosphorus more readily available to vegetation. The existence of phosphorus in several unavailable forms is sometimes advantageous in that it helps to conserve the phosphorus supply in the soil and makes the effects of superphosphate applications last for several years. Copper and sulfur are often added to the soil in available forms through the use of spray solutions. Other elements are added by direct application or by the use of specific artificial fertilizers.

Soil Pollution. The increasing amounts of fertilizers and other agricultural chemicals applied to soils since World War II, plus industrial and domestic waste disposal practices, have led by the mid-1960's to increasing concern over soil pollution. Soil pollution is the build-up in soils of persistent toxic compounds, chemicals, salts, radioactive materials, or disease-causing agents, which have adverse effects on plant growth and animal health. As of now, soil pollution is not widespread. Although the application of fertilizers containing the primary nutrients, nitro-

Intensive programs of research are undertaken by scientists seeking solutions to soil problems, as here conducted at the Soil Research Institute of Canada. Above, left: A researcher observes the growth of iron-oxidizing bacteria during an experiment concerning the movement of iron in soils. Above, center: A final negative is retouched in preparation of a soil map. Above, right: A soil sample is prepared for wall mounting.

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gen, phosphorus, and potassium, has not led to soil pollution, the application of trace elements has. The irrigation of arid lands often leads to pollution with salts. Sulfur from industrial wastes has polluted soils in the past, as has the accumulation of arsenic compounds in soils following years of spraying crops with lead arsenate.

The application of pesticides has also led to short-term soil pollution.

Pesticide Residues. The effectiveness of a pesticide as well as the hazards of harmful residues depend largely on how long the pesticide remains in the soil. For example, DDT (q.v.), a chlorinated hydrocarbon, has a half-life of three years in cultivated soils, while organophosphorous insecticides persist for only days or months. Chlorinated hydrocarbons persist longer in soils having a large amount of organic matter, although more of the chemical must be applied to these soils in order to kill pests. Insecticides persist longer if worked into the soil than if left on the surface. Herbicides applied to soils may not persist at all or may persist up to two years or longer, depending on the compound. Simiazine is one of the most persistent herbicides. Eventually, all pesticides disappear because of volatilization, leaching, plant uptake, chemical and microbial decomposition and photodecomposition.

Soil Acidity Adjustment. Maintenance of specific soil acidities is important in soil management because it controls the adaptation of various crops and native vegetation to different soils. For example, cranberries can be success-

SOISSONS

fully grown only in moderately to strongly acid soils, whereas alfalfa and other legumes are successful only in weakly acid or slightly alkaline soils. The ordinary procedure for correcting excess soil acidity is the application of lime in the form of limestone, dolomitic limestone, or burnt lime. About 20,000,000 tons of limestone are used annually on U.S. farms. When lime is added, the hydrogen of the complex soil colloid is exchanged for the calcium of lime. Acid soils are found predominantly in regions of high rainfall; in arid regions, the soil is usually alkaline.

Mechanical Control of Erosion. The mechanical loss of fertile topsoil is one of the gravest problems in agriculture. Such loss is almost always caused by erosion which may occur as the result of the action of water or of wind. According to the United States Department of Agriculture, more than half of all fertile U.S. topsoil has been damaged to some extent by erosion. For a discussion of the problem and the various methods for combating erosion, see CONSERVATION: *Soil Conservation*. See also DRAINAGE.

SOISSONS, city of France, in Aisne Department, on the Aisne R., 65 miles N.E. of Paris. The principal industries include the manufacture of sugar, boilers, glass, iron and copper foundry products, flannel, leather, farm implements, and rubber goods. The city is also an important commercial center with a considerable trade in grain, livestock, beans, sugar beets, and flour. The principal building is the Cathedral of St. Gervais (or Notre-Dame), constructed during the 12th and 14th centuries. Other notable structures include the remains of the Abbey of Saint Jean-des-Vignes, in which the English prelate Thomas à Becket (q.v.) found refuge during his exile from England; the 8th-century Abbey of St. Mélard; the Abbey of Saint Léger, built from the 11th to the 12th Centuries, which is now a museum; and the 12th-century Church of Saint Peter (Romanesque).

History. Soissons is one of the most ancient cities of France. In Roman times it bore the names of *Noviodunum*, *Augusta Suessionum*, and *Suessiona*. Soissons is famous for the victory there of the Merovingian King Clovis I (q.v.), in 486 A.D. over Syagrius (430?-486), a former Roman governor who had made himself ruler of a territory in northern Gaul. During the Hundred Years' War (q.v.) in the 15th century, the city was captured and sacked a number of times. Soissons was again sacked, by the Huguenots (q.v.), in 1565. In 1814, during the Napoleonic Wars (q.v.), the city changed hands several times, and in 1870, during the Franco-German

War, it was shelled and captured by the Germans. During World War I Soissons was again captured by the Germans, but was retaken by French and British forces. It also was the scene of heavy fighting during World War II. Pop. (1968) 27,641.

SOLANUM, genus of herbs, shrubs, and trees belonging to the Nightshade family, Solanaceae. The genus, which contains about 1500 species, is native to many temperate, subtropical, and tropical countries, and is most abundant in tropical America; three species, the potato, tomato, and eggplant (qq.v.), are widely cultivated for food. A few species are cultivated as ornamentals, including the Jerusalem cherry, *S. pseudocapsicum*, a house plant popular for its persistent bright-red berries, and the potato vine, *S. jasminoides*, a climbing shrub that grows to a height of about 20 ft. See also BITTERSWEET.

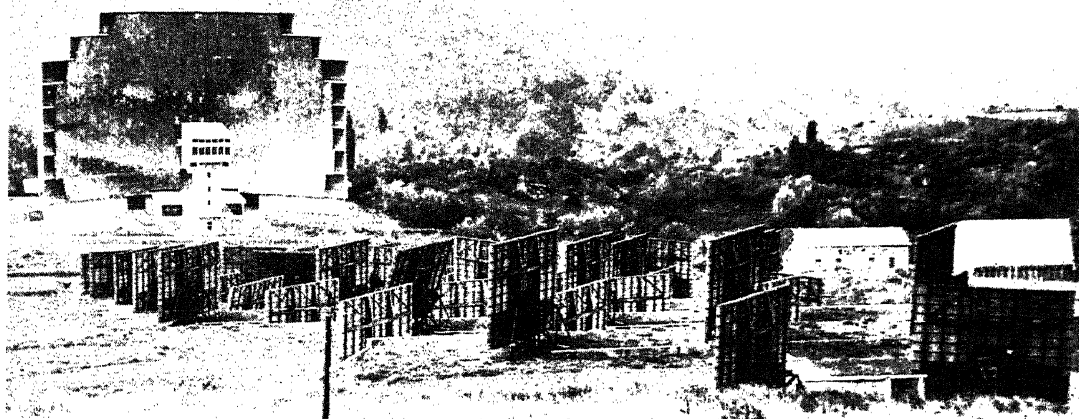
SOLAR BATTERY. See CELL, ELECTRIC: *Solar Battery*.

SOLAR HEATING. See HEATING, VENTILATING, AND AIR CONDITIONING: *Special Heating Systems*; SOLAR POWER.

SOLAR PLEXUS, or COELIAC PLEXUS, major network of nerves situated in the coeliac, or abdominal cavity, behind the stomach and in front of the aorta. This network controls all the important organs in the abdomen, such as the liver, pancreas, spleen, and kidneys. A direct blow in the solar plexus is capable of knocking an adult unconscious, and this sensitive area of a boxer's body is frequently the target of his opponent's punch; see BOXING. See also NERVOUS SYSTEM: *Anatomy and Function*.

SOLAR POWER, radiant energy from the sun transformed into work potential by thermal, photochemical or electrical processes; see ELECTRICITY; ENERGY; RADIATION; SUN; WORK. Produced by atomic transmutation of the chemical elements in the sun's interior, solar energy represents a vast, inexhaustible source of future power; see ATOM AND ATOMIC THEORY; NUCLEAR ENERGY. Its utilization has long been a goal of scientific researchers but, despite recent technological advances, present methods for converting solar energy into useful power are more costly than the techniques employed in the production of conventional power.

Basically, two techniques are used for harnessing the sun's energy by thermal processes. In one, the radiation is collected by means of flat plates of large area, and in the other, the energy is concentrated by focusing mirrors; see MIRROR. Flat-plate collectors have been used for solar water heaters, mechanical pumps, and in domestic heating and cooling systems; see HEAT-



ING, VENTILATING, AND AIR CONDITIONING: *Heating: Special Heating Systems.* This technique is fairly efficient in operations not requiring a temperature output above the normal boiling point (q.v.) of water; see HEAT; TEMPERATURE.

For producing temperatures above 100° C. (212° F.), concentrators of various sizes have been developed. Small, parabolic reflectors, for example (see PARABOLA), are used as cookers; larger reflectors are employed as furnaces; and flat mirrors, focused at a central point, are applied in steam boilers and other devices.

Solar Furnace. The earliest type of solar-energy device is the solar furnace, which uses the sun's energy for research purposes or for the generation of electric power. Although the latter use has not yet proved to be competitive economically with fossil-fuel-fired, nuclear-power, or hydroelectric generators, research is continuing to improve the economic feasibility of solar generation; see NUCLEAR POWER. The world's first solar furnace was built in Jena, Germany, in 1921. A similar furnace, built in the United States, is a 120-in.-diameter unit for high-temperature testing of metals (q.v.) associated with the structure of aircraft and missiles. See METALLURGY. Other solar furnaces are in use at Mont-Louis, France; the Buzareah Laboratory, Algiers, Algeria; Fordham University in New York City; and at the United States Air Force Holloman Air Development Center in New Mexico. At both the Fordham and the U.S. Air Force installations, parabolic mirrors have produced temperatures close to 4000° C.

The world's largest solar furnace, however, is the installation at Odeillo in the French Pyrenees. Built by the French government, it consists of 63 flat, mirrored panels, each consisting of 180 small mirrors, set on a hillside, and 9000 mirrors mounted on a 200 ft.-high by 250 ft.-wide parabolic wall. The wall concentrates the sun's rays on target materials placed in a nine-

A giant solar furnace built in Odeillo in the French Pyrenees consists of 63 flat mirrored panels (each holding 180 small mirrors) on the hillside, in the foreground; 9000 mirrors mounted on the parabolic wall of the 9-story building in the background; and a hammerhead-shaped tower in front of the wall which is the focal point for very high temperatures (exceeding 7000° F.) reached by the furnace.

The New York TIMES

story hammerhead-shaped tower that is situated in front of the wall. In tests, 16-in. diameter holes have been burned through ½-in. thick steel plates in a few seconds; and when the alignment of the mirrors is completed, temperatures of 7000° C. are achieved.

Other Applications. The solar cell, also called a photovoltaic cell, is a form of photoelectric cell (q.v.) that uses semiconductor materials to convert sunlight directly into electricity. It was developed at Bell Telephone Laboratories in 1954. Its power-generating ability is limited, and large arrays of cells must be connected to produce a significant voltage. Solar cells are used to power the equipment aboard spacecraft; their application on earth has been confined to providing power for buoys, unattended light-houses, and radio repeater networks. Efforts are under way to increase the efficiency of solar arrays, and many scientists are optimistic about their potential.

The possibility of using solar energy as the prime power source for space vehicles is being explored. One proposed form would be that of solar sails driven by the pressure of solar radiation which, although very low, may be sufficient to propel space vehicles between points of very low gravity; see ASTRONAUTICS.

An important solar process is the production of hydrogen by the photochemical effect of sunlight on water. Hydrogen thus obtained may be stored for use in a fuel cell (q.v.), a device that produces electrical energy with a high degree of efficiency.

Other research projects involving solar energy are designed to increase world food supplies.

SOLAR SYSTEM

Solar stills to convert saline or brackish water into fresh water are in experimental use. The rate of growth of certain crops can be increased appreciably by the use of solar reflectors.

In 1974 the U.S. government sponsored several research and demonstration programs designed to speed application of solar power. The following year the Energy Research and Development Authority established a technical information center on solar-energy uses, which included teaching local construction firms how to incorporate solar collecting plants into homes for heating, air conditioning, and hot-water supplies. G.D.F.

SOLAR SYSTEM, cosmic unit consisting of the sun (q.v.) and the many smaller bodies under its influence that revolve around it. The system includes the planets, such as the earth; their satellites, such as the moon; and the planetoids, the comets, and the swarms of meteors. See separate articles on each member of the solar system. For theories regarding the origin of the solar system, see COSMOGONY. For the position and motion of the solar system with reference to the nearest stars and to the center of the Milky Way, see MILKY WAY. See also ASTRONAUTICS; ASTRONOMY; COMET; GALAXY; METEOR; PLANET.

SOLAR TIME. See TIME.

SOLAR WIND. See RADIATION BELTS.

SOLDER, any of several metallic alloys which melt at comparatively low temperatures, and which are used for the patching or joining of metals (q.v.). Solders are commonly classified as soft and hard solders, depending upon their melting points and strengths. Soft solders are alloys of lead and tin, sometimes with the addition of bismuth; hard solders are alloys of silver, copper, and zinc (silver solder) or of copper and zinc alone (brazing spelter).

In joining two pieces of metal with solder, the joining surfaces are first cleaned mechanically and then coated with a flux, usually of rosin or borax, which cleans them chemically and assists the solder in making a bond. The surfaces are then heated, either with a hot metal tool called a soldering iron or soldering copper, or with some form of alcohol or gas blowpipe. When the surfaces are heated to the melting point of the solder, the solder is applied and runs freely, solidifying as the surfaces cool. In the form of soldering known as sweating, the pieces to be joined are first coated individually with solder, and are then clamped together and heated to form the finished joint. Soldering is not significantly different from brazing and welding (qq.v.) as a method of joining metals, except that soldering metals and alloys used for joining

have less physical strength and lower boiling points.

SOLE, flatfish, *Trinectes maculatus*, of the family Soleidae. An American sole, also called hogchoker, is only about 6 in. long; the common sole of Europe, *Solea solea*, attains a length of from 10 to 20 in. The shape of the fish is oval, the outline of the snout being semicircular and projecting beyond the mouth. See FLATFISH.

SOLENODON, genus of small, long-nosed animals in the family Solenodontidae, native to the West Indies. The solenodon is a rare animal and its exact origin a mystery. It reaches a length of 2 ft. including a 9-in. naked tail and weighs about 2½ lb. It has forty teeth and in its rusty brown fur it resembles a rat with a long snout. Nocturnal in its habits, the solenodon lives in hollow logs and in rocks from which it emerges at night to hunt insects and reptiles. Only two species exist, the dark-brown Haitian solenodon, *S. paradoxus*, and the Cuban solenodon, *S. cubanus*, which has a tawny yellow head. Because the solenodon has a low rate of reproduction and is preyed on by domestic dogs and cats, it is believed to be in danger of extinction.

SOLFERINO, BATTLE OF, engagement fought on June 24, 1859, between the Franco-Sardinians commanded by the French emperor Napoleon III and the Austrians under Emperor Francis Joseph I (qq.v.). The battle was won, although not decisively, by the Franco-Sardinians. The victory precipitated the end of the Italian war of liberation, thus securing independence for most of Italy; see ITALY: *Risorgimento*. The battle was fought in the village of Solferino, in Lombardy Region, about 18 miles N.W. of Mantua.

SOLICITOR GENERAL. See JUSTICE, DEPARTMENT OF.

SOLID, in mathematics, that limited portion of three-dimensional space lying within boundary limits.

In physics and chemistry, a solid is the physical state of matter in which samples maintain their shape and size. Some highly viscous liquids, such as very cold molasses, flow so slowly that they seem to retain their size and shape and thus appear to be solids. X-ray examination, however, reveals an important difference in microscopic structure. Solids exhibit a regular arrangement of atomic, ionic, or molecular particles; liquids show irregular arrangements. That is, fundamentally solid objects have a crystalline structure, liquids do not.

SOLID GEOMETRY, branch of geometry (q.v.) that deals with the properties and measurement of geometric figures in three-dimensional space. Such figures include the cone, cylinder,

pyramid, sphere (qq.v.), and prism. Solid geometry extends and reinforces the propositions of plane geometry and is the necessary foundation for spherical trigonometry, solid analytical geometry, descriptive geometry, and other branches of mathematics. It is widely used in mathematics, engineering, and the natural sciences. See ANALYTIC GEOMETRY; DESCRIPTIVE GEOMETRY; TRIGONOMETRY. J.Si.

SOLID-STATE PHYSICS. See PHYSICS: *Developments in Physics Since 1930: Solid-State Physics*; TRANSISTOR.

SOLIHULL, Great Britain, county borough of Warwickshire, England, on the Blythe R., adjoining and 7 miles S.E. of the center of Birmingham. An industrial center, it manufactures metallurgical products, machinery, automobiles, and electrical goods. A restored church dates from the 13th and 15th centuries, and Old Berry Hall was built in the 15th century. The Forest of Arden is nearby to the E. Pop. (1971) 106,968.

SOLINGEN, city of West Germany, in North Rhine-Westphalia State, 13 miles S.E. of Düsseldorf. It is famous for its steel and iron ware, especially knives, scissors, and surgical instruments, which are exported to all parts of the world. Solingen is also the site of iron foundries and cigar factories. The city was chartered in 1374 and was a member of the Hanseatic League (q.v.). Pop. (1970) 177,100.

SOLITAIRE, common name applied to various species of the American thrush, Turdidae, family in the genus *Myadestes*. In the United States the genus is represented by one species, Townsend's solitaire, *M. townsendi*. Members of the species, found chiefly in the Rocky Mts., are largely brownish gray in color, with a white eyering and a buffy wing patch. All members of the genus are superb singers.

Solitaire, *Pezophaps solitaria*, was also the name of an extinct, flightless bird resembling the dodo (q.v.). It inhabited Rodrigues, an island in the Indian Ocean, until the last half of the 18th century.

SOLITAIRE, American term applied to any of various games of cards that can be played by one person. The English term for such games is "patience".

In most games of solitaire one or more full decks of fifty-two cards are used, with the cards dealt to the table in some plan or pattern, usually according to an arbitrary arrangement known as a tableau. This pattern customarily is laid out before the start of play, but in some games it is formed during play. The game develops out of the undealt portion of the deck, known as the hand, which is turned up a card or

more at a time, cards being played into the tableau as available or suitable.

The object of most solitaire games is to build, or form, sequences of cards in ascending or descending order; that is, from the ace up to the king or from the king down to the ace (the king is usually high card), often in an endless sequence. Suits (all cards in a complete deck or pack bearing the same symbols) have no comparative rank, hearts and diamonds being called red and spades and clubs black. The rules of play may require that sequences be built up in one color, in alternating colors, or in one suit alone. Occasionally, one or more of these methods is permitted during the course of play.

Canfield Solitaire. One of the most popular of the numerous variants of solitaire is Canfield, so called because it is said to have been devised by the American gambler and art collector Richard Albert Canfield (1855-1914). Many persons consider Canfield the most typical as well as the most challenging game of solitaire.

In Canfield thirteen cards are counted off the top of the deck and placed face down in a pile known as the stock, the top card of this stock being turned up. The fourteenth card turned up thereafter in play also becomes a foundation card, so that eventually four separate foundation piles are formed. The next four cards after the fourteenth are dealt in a row face up to the right of the stock and below the foundation to form the tableau. The remainder of the deck forms the hand. The object of the game is to get all fifty-two cards or as many as possible into the foundation piles.

The player continuously turns up packets of three cards from the hand, exposing the third card. These are placed in a waste or discard pile known as the talon. In each such turn the exposed card is available for play, on a tableau card in descending order and in alternating colors, that is, red or black, or on a foundation card in ascending order and in the same suit only. The top card of the stock, which is exposed continuously, also is always available for such play. Playable cards may be shifted from one part of the tableau to another or from tableau to foundation piles, but must remain in the foundations once played there. Play stops when cards can no longer be played into the foundation. Canfield turned this game into a form of gambling by collecting from the player one chip for each card of the pack at the start of the game and paying him five chips for each card he could work into the foundation piles. The odds against the player in this game are far greater than five to one.

Klondike and other Variants. Another extremely popular game of solitaire is Klondike, often confused with and misnamed Canfield because both games are based on similar principles. The layout, or first dealing of the cards, and play are different, however. Hundreds of variants of solitaire besides Canfield and Klondike are played, and many of these have several different names. Thus, one popular solitaire game is known variously as Napoleon at St. Helena, Big Forty, and Forty Thieves. Other variants are Idiot's Delight, Streets and Alleys, Spiders, and Tower of Babel.

See also CARDS, PLAYING.

SOLO. See SURAKARTA.

SOLOMON, King of ancient Israel (r. 961?–922 B.C.), second son of David (q.v.), King of Judah and Israel and Bath-sheba (q.v.; 2 Sam. 12:24). In later Jewish and Muslim literature Solomon appears not only as the wisest of men, but as one gifted with the power to control the spirits of the invisible world. He is frequently noted in history and literature as the builder of the Temple; see TEMPLE: *Temple at Jerusalem*.

Solomon succeeded his father despite the claims of Adonijah, his older half brother (1 Kings 1:1–40). He divided Israel into twelve parts for administrative purposes, and his territory extended “from the river [Euphrates] unto the land of the Philistines, and unto the border of Egypt” (4:21); see PHILISTINES. He made bondsmen of the Canaanites (q.v.) who remained in the land (9:20–21), and formed an alliance with Hiram, King of Tyre (fl. 10th cent. B.C.) (now Sur, Lebanon). In return for food, Hiram furnished him with timber, and the ships of the allies went out trading together. The Temple, completed in about seven years, was built in great splendor with Hiram's aid and dedicated with much magnificence (1 Kings 8).

Solomon's distinguishing quality was as an administrator. He kept the united kingdom largely intact, strengthened its fortifications, and made alliances not only with Tyre, but with several other nations surrounding Israel. Commerce, consisting of trade by caravan and by sea, and an extensive copper-mining industry were encouraged by the international intercourse. Contact with other nations also resulted in a marked intellectual advance, and it may be assumed that genuine literary activity was carried on. The new epoch thus marked by Solomon's reign is sufficient to account for the later traditional view of Solomon himself as an author of high skill and remarkable output. The writings that have been ascribed to him are the Biblical Proverbs, the Song of Solomon, Ecclesi-



“Solomon the Wise”, drawing by the 19th-century French illustrator Gustave Dore.

astes, the Wisdom of Solomon (qq.v.), and the later so-called Psalms of Solomon and Odes of Solomon. They belong to various periods, however, and modern scholars have determined that several were written centuries later. The Odes, indeed, are possibly of Gnostic Christian authorship; see BIBLE: *The Growth of the Bible*; GNOSTICISM.

Despite his reputation for wisdom, it would seem that Solomon's extravagance and somewhat Oriental disregard for his people were at least partly responsible for the later disruption of the kingdom. Outside conditions, moreover, contributed to his original success. The larger empires were occupied with their own affairs at this time, and Israel's trade and industry flourished in the absence of extensive warfare. See ASSYRIA; JEWS: *The Kingdom*.

SOLOMON ISLANDS, group of about thirty islands and numerous atolls, in the South Pacific Ocean, E. of New Guinea. The group, which stretches over about 1450 km (900 mi.) of ocean, is situated between about lat. 4°55' S. and lat. 11°40' S. and between about long. 154°10' E. and long. 163° E. It has a total area of approximately 40,145 sq.km (15,500 sq.mi.). Most of the islands

are included in the Solomon Islands, an independent country; these include Guadalcanal (q.v.), New Georgia, Santa Isabel, Malaita, Choiseul, San Cristobal (Makira), and Vella Lavella. The rest of the island group, principally Bougainville (q.v.) and Buka, is part of Papua New Guinea (see PAPUA).

The islands are mountainous and rise to 2591.3 m (8502 ft.) at Mt. Balbi, on Bougainville, and to 2330.8 m (7647 ft.) at Mt. Popomanaseu, on Guadalcanal. The mountains are of volcanic origin and are heavily forested. The only active volcano is Mt. Balbi. The climate of the islands is hot and humid. The chief products are copra, timber, rice, cacao, processed fish, sweet potatoes, plantains, pineapples, and trochus shells (used in making buttons and ornamental objects). There are large deposits of bauxite and phosphate rock, and alluvial gold is produced on Guadalcanal. Melanesians make up most of the population, and there are some Polynesians.

The nation of the Solomon Islands, which also includes the Santa Cruz Islands, has an area of 29,785 sq.km (11,500 sq.mi.) and a population (1976 census) of 196,823. Its capital is Honiara (pop., 1976, 14,993), on Guadalcanal. The chief government official is a prime minister, who must have the confidence of the nation's elected thirty-eight-member unicameral parliament. The British sovereign is the head of state. The country is a member of the Commonwealth of Nations and the United Nations.

History. The Solomon Islands were discovered in 1568 by the Spanish navigator Álvaro de Mendaña de Neyra (1541–95). The northernmost islands of the group were explored in 1768 by Louis Antoine de Bougainville (q.v.), for whom the island of Bougainville is named. The Germans established control over the N. Solomons in 1885, but in 1900 they transferred these islands, except Bougainville and Buka, to the British, who had declared a protectorate over the central and S. Solomons in 1893. In 1914, at the start of World War I, Australia occupied the remaining German Solomons, and in 1919 the League of Nations granted the area to Australia as a mandate. Most of the Solomons were occupied by Japan in 1942, during World War II, and there was heavy fighting in the region, especially on and around Guadalcanal, before the Allies forced the last Japanese to leave the island group in 1945. In 1975 the Australian-administered Solomons became independent as part of Papua New Guinea. The British Solomons gained independence as the Solomon Islands on July 7, 1978; the first prime minister of the nation was Peter Kenilorea (1943–).

SOLOMON'S SEAL, common name applied to any of the perennial herbs constituting the genera *Polygonatum* and *Smilacina* in the Lily family; see LILIACEAE. These plants are so called because when they die, their annual above-ground stems leave seal-like scars on the creeping, perennial, underground rhizomes. The true Solomon's seals constitute the genus *Polygonatum*, which contains about thirty species native to the North Temperate Zone. The common Eurasian Solomon's seal, *P. multiflorum*, which has black berries, is widely cultivated as a garden and house plant. The great Solomon's seal, *P. commutatum*, is a common wild flower.

The false Solomon's seals comprise the genus *Smilacina*, native to Asia and America. Several species are cultivated for their fragrant, white flowers and bluish-green foliate, including the false spikenard, *S. racemosa*, native to the northern United States and to southern Canada, which bears berries that turn ruby red in the fall.

SOLOMON, WISDOM OF. See WISDOM OF SOLOMON.

SOLON (638?–559? B.C.), Athenian statesman and legislator, born of a noble family. As a young man he engaged in foreign trade, from which he gained valuable experience. During his lifetime, a crisis occurred in social and economic conditions in Greece. As a result of the growing importance of commerce, Athenian capital had become concentrated in the hands of a small number of merchants, while the small farmers and agricultural laborers were burdened by debt. Many free Athenians who could not pay their debts were sold into slavery. In 594 B.C., Solon was elected archon, or chief magistrate, and reformed oppressive conditions.

Solon immediately forbade borrowing money on the security of the person of the debtor and canceled all current mortgages and debts. A limit was placed on the accumulation of land, and a reform of the monetary standard was effected, giving relief to the poor and benefiting Athenian trade abroad. Equally important were Solon's constitutional reforms. He retained the older division of the people into classes according to wealth: the *Pentacosiomedimni*, whose annual income equaled 500 *medimni* (1 *medimnus* = 1½ bu. or 8½ gal.) of grain, wine, or oil; the *Hippeis*, or Knights, who could supply a war-horse for military service and whose income amounted to 300 *medimni*; and the *Zeugitae*, or Teamsters, who could supply a yoke of oxen and had an income of 200 *medimni*. To these classes he added as a fourth class the *Thetes*, who in general were without property. Political offices were open only to members of the first

SOLON

three classes, but to the Thetes he gave the right to take part in the public assembly. This step was important in the development of popular government, for the selection of the assembly out of the entire citizen body gave the people control over the administration. A new council, composed of 400 members, was formed to prepare proposals for the general assembly. The as-



Solon

sembly received many of the legislative functions formerly possessed by the Council of the Aeropagus (q.v.). On each of the four classes Solon also imposed certain duties. The three highest provided the land army of Attica, while the Thetes, as rowers in the triremes, ancient ships with three banks of oarsmen, formed the most important part of the navy, one day to prove the salvation of Greece and the mainstay of the Athenian empire.

Solon's regulations ranged over every province of life, including marriage, adoption, clothing, farming, and the calendar. Although many details of his legislation are obscure and disputed, Solon undoubtedly emancipated the individual and took the first decisive step toward complete and true democracy. The keynote of his reforms was moderation, and he believed that each class should receive privileges in proportion to the public burdens it was able to bear. The reforms met with dissatisfaction, however, being too democratic to please the wealthier aristocrats and not democratic enough to suit the people. Tradition indicates that Solon met with such opposition, in fact, that following his year in office, he withdrew from Athens for a decade.

Solon, considered the founder of Athenian democracy, occupies a prominent position also

as the first Athenian poet. The extant fragments of his verse are valuable both as poetry and as statements of his political aims. Solon was considered one of the Seven Wise Men of Greece (q.v.).

SOLSTICE, in astronomy, term applied to either of the two points in the ecliptic (q.v.) at which the sun is farthest from the celestial equator. The solstice north of the celestial equator is called the summer solstice because the sun is at its greatest declination on June 22 (at the beginning of summer in the Northern Hemisphere); the solstice south of the celestial equator, called the winter solstice, occurs on Dec. 22. The seasons are the reverse of the above for people living in the Southern Hemisphere. The term solstice means "sun stands still"; at these times the sun changes little in declination and appears to remain in one place north or south of the celestial equator.

SOLUTION. See **CHEMISTRY: Physical Chemistry: Solvent.**

SOLVAY, Ernest (1838–1922), Belgian industrial chemist and manufacturer, born in Brussels, started work as a helper in a gas factory. His greatest achievement was the development of the ammonia process for the manufacture of soda (q.v.), and its supply on a commercial basis. Solvay's first factory was established at Couillet, Belgium, in 1863, and the production processes were continually improved upon until 1872, when patents were granted to him covering the process in its present form. Solvay built many soda factories throughout the world, and also became well known for his philanthropic activities.

SOLVAY PROCESS. See **SODA.**

SOLVENT, liquid substance that dissolves or breaks down another substance into a more elementary form and is usually present in greater quantity than that substance. Water, for example, is a solvent for table salt. A quantity of table salt, sodium chloride, when mixed with water, breaks down into its constituents, sodium and chlorine ions (see **ION**) that are evenly dispersed throughout the water. In this case, the water is the solvent, the salt is the solute, and the mixture is a solution. The solute, however, is not simply a passive or inert constituent of a solution. Both solvent and solute can be considered active. A solvent can itself have a complex composition; for example, the alcohol used in making so-called tinctures always contains 5 percent or more of water.

Solvents have a particular importance commercially. By selecting the proper solvent, it is possible to separate one ingredient or group of

ingredients from a complex substance. This process is called solvent extraction. A solvent can, for example, remove a fragrance or flavor from a complex plant or animal substance. Once dissolved, the fragrance or flavor can be concentrated by then evaporating the solvent. In a well-designed solvent-extraction process, the solvent is recovered and used over and over again. Nearly three quarters of the soybean oil produced in the United States is extracted by the use of liquid hexane as a solvent.

Solvent-extraction systems must be designed and operated with great care. The flavor of a fruit, for example, is not due to a single substance, but to a complex combination of substances. Strawberry essence has more than eighty constituents, and orange flavor has more than ninety. If the proportions of these constituents are changed by the solvent extraction process, the resulting aroma or taste may be undesirably altered.

See also COLLOIDAL DISPERSION; ESSENTIAL OIL.

SOLWAY FIRTH, inlet of the Irish Sea, separating N.W. Cumberland, England, from S. Scotland. It is 40 mi. long and varies in width from 1 to 22 mi. The principal rivers flowing into it are the Esk, Annan, Nith, Dee, and Urr Water from the N. or Scottish side, and the Eden and Derwent from the S. or English side. The main ports are Kirkcudbright, in Scotland, and Sillioth, Maryport, and Whitehaven, in England. A striking feature of this inlet is the great rapidity of its tides. They cause tidal floods, called bores, which occur regularly with a roaring noise. Solway Firth has valuable salmon fisheries.

SOLYMI. See BELLEROPHON; LYCIA.

SOLZHENITSYN, Aleksandr Isaevich (1918–), Soviet writer, born in Koslovodsk, and educated at the University of Rostov. He served in the Soviet army from 1941 to 1945, when he was sentenced to eight years in prison for anti-Stalinist remarks written to a friend. His prison experiences were the background for his first novel, *Odin den' Ivana Denisovicha* (1962; Eng. trans., *One Day in the Life of Ivan Denisovich*, 1963). Three short stories published in the Soviet Union have appeared in the United States in book form as *We Never Make Mistakes* (1963) and *For the Good of the Cause* (1964). In 1969 Solzhenitsyn was expelled from the Soviet Writers Union for denouncing the official censorship that had suppressed publication of some of his writings. Three novels have been published in English translation: *The First Circle* (1968); *Cancer Ward* (in various editions, 1968–69); and *August 1914* (1971). Solzhenitsyn was awarded the 1970 Nobel Prize in literature.

Subject to continuous harassment by Soviet authorities, Solzhenitsyn was finally deported to the Federal Republic of Germany and deprived of his Soviet citizenship in February, 1974. In October he went to Sweden to accept his Nobel Prize. His massively documented exposé of the Soviet prison system, terrorism, and secret police, first published in France (1973), appeared shortly afterward in English as *The Gulag Archipelago, 1918–1956* (1974) and *The Gulag Archipelago 2 and 3* (1975; 1978).

SOMALI, people of E. Africa, living in Somalia, Djibouti, S.E. Ethiopia, and N. Kenya and numbering about 3,000,000 in the late 1970's. The Somalis are generally tall and dark-skinned and speak a Cushitic language (see AFRICAN LANGUAGES: *The Afro-Asiatic Family*). Almost all the Somalis are Muslims, the majority of whom adhere to the Sunnite branch of Islam. Although some Somalis dwell in towns or are settled agriculturalists, most still live in the traditional manner as nomadic pastoralists, herding camels and, to a lesser extent, sheep and cattle. The main social unit is a group of several families tracing their descent from a common male ancestor.

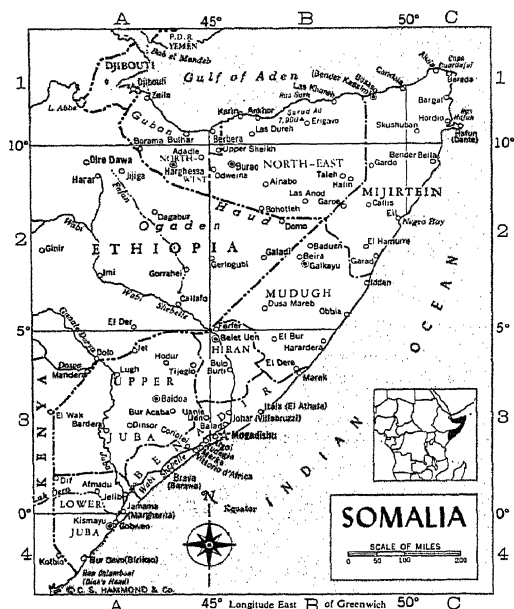
SOMALIA or SOMALI DEMOCRATIC REPUBLIC, republic of E. Africa, bounded on the N. by the Gulf of Aden, on the E. and S. by the Indian Ocean, on the S.W. by Kenya, on the W. by Ethiopia, and on the N.W. by Djibouti. The country is situated between about lat. 12° N. and lat. 1°40' S. and about long. 41° E. and long. 51°25' E. The total area is about 246,000 sq.mi.

THE LAND

Somalia has a long coastline, extending for about 1700 mi., but it has few natural harbors. A sandy coastal plain, varying in width from about 1 to 60 mi., borders on the Gulf of Aden. Inland from the plain is a series of mountain ranges, with average elevations between 3000 and 7000 ft. The interior consists of a rugged plateau, ranging in elevations from about 7900 ft. in the N. to about 2000 ft. in the S. area. An arid region of grassy plains is located in the S. portion of the plateau. In the S., a wide coastal plain, which has many sand dunes, borders on the Indian Ocean. Inland the area consists of an arid plateau, an extension of the one in the interior of the country. The two major rivers are found in this region, namely, the Juba in the S. part and the Wabi Shebelle in the S. central section.

Vegetation consists chiefly of coarse grass and stunted thorn and acacia trees. Aromatic flora, producing frankincense and myrrh, are indigenous to the mountain slopes. In S. Somalia, eucalyptus, euphorbia, and mahogany trees are found. Wildlife includes the crocodile, ele-

SOMALIA



INDEX TO MAP OF SOMALIA

Regions

Benadir	A 3
Hiran	B 3
Lower Juba	A 3
Migiurtinia	B 3
Mudugh	B 3
North-East	B 3
North-West	A 3
Upper Juba	A 3

Cities and Towns

Afgoi	B 3
Atmadu	A 3
Audegle	B 3
Baidoa	A 3
Balad	B 3
Barawa (Brava)	A 3
Bardera	A 3
Belet Uen	B 3
Bender Beila	C 2
Bender Kassim (Bosaso)	B 1
Berbera	B 1
Birikao (Bur Gavo)	A 4
Borama	A 1
Bosaso	B 1
Brava (Barawa)	A 3
Bulo Burti	B 3
Bur Acaba	A 3
Bur Gavo (Birikao)	A 4
Burao	B 2
Candale	B 1
Coriole	A 3
Dante (Hafun)	C 1
Dinsor	A 3
Dusa Mareb	B 2
Eil	B 2
El Athale (Itala)	B 3

El Bur	B 3
El Dere	B 3
Galkayo	B 3
Gardo	B 2
Garo	B 2
Gobwen	A 4
Hafun (Dante)	C 1
Hargeessa	A 2
Hodur	A 3
Hordio	C 1
Jamama	A 3
Itala (El Athale)	B 3
Jelib	A 3
Johar	B 3
Kismayu	A 4
Las Anod	B 2
Las Khoreh	B 1
Lugh	A 3
Margherita (Jamama)	A 3
Merka (Merca)	A 3
Mogadishu (cap.)	B 3
Obbia	B 2
Tijeglo	A 3
Uanle Uen	A 3
Villabruzzi (Johar)	B 3
Vittorio d'Africa	A 3
Zeila	A 1

Physical Features

Aden (gulf)	B 1
Chiamboni, Ras (Dick's Head) (cape)	A 4
Guardafui (cape)	C 1
Guban (region)	A 1
Hafun, Ras (cape)	C 1
Juba (river)	A 3
Negro (bay)	C 2
Surud Ad (mt.)	B 1
Wabi Shebelle (river)	A 3

phant, giraffe, leopard, lion, zebra, and many poisonous snakes.

Climate. The climate ranges from tropical to subtropical. Temperatures usually range between 76° F. and 88° F., but are occasionally as low as 32° F. in the mountain areas and as high as 116° F. along the coast. The seasons are gov-

erned by the monsoon winds, which bring a dry season from September to December and a rainy season from March to May. The average annual rainfall is about 11 in.

Natural Resources. Somalia has few natural resources. The grasslands are suitable for grazing livestock, and the fertile land in the river valleys of the Juba and Wabi Shebelle and in some coastal areas is used for agricultural crops. The mineral resources, which have not been exploited, include feldspar, gypsum, iron ore, marble, meerschaum, tin ore, and uranium.

THE PEOPLE

The majority of the population consists of Somalis, a Hamitic people (see SOMALI). A significant minority of Bantu (q.v.) people live in the s. part of the country. Other minority groups include Arabs, Indians, Italians, and Pakistanis. Most of the people are nomadic pastoralists. The remainder are either farmers or inhabitants of the few urban centers.

Population and Political Divisions. According to a recent estimate (1972) the population was 2,930,000. The overall population density is 12 per sq.mi. (1972 est.). The country is divided into eight regions: Benadir, Hiran, Lower Giuba, Migiurtinia, Mudugh, Northeast, Northwest, and Upper Giuba. The principal cities are Mogadishu, the capital, which has a population of 200,000 (1972 est.), and Hargeessa (50,000).

Religion and Language. Islam is the state religion and most of the people are Sunni Muslims; see MUSLIM SECTS. A small minority are Roman Catholics. The official languages are Arabic, English, and Italian, but the majority speak Somali, a Cushitic language without an accepted written form.

Education. Education is free but not compulsory. The literacy rate is about 5 percent. In the late 1960's the educational system consisted of 211 elementary schools, with an enrollment of about 21,000 pupils; 40 intermediate schools, attended by about 7500; and 13 secondary schools, with an attendance of about 1800 students. Teacher training was provided by 3 institutions, with an enrollment of about 400 students. The principal institution of higher learning is the University Institute of Somalia founded in 1954 in Mogadishu, with a student body of about 800.

THE ECONOMY

The economy of the country is based primarily on livestock raising. Agriculture is of major importance in s. Somalia. The government is operating under a series of development plans, extensively assisted by foreign grants and loans. The basic objectives of the plans are improve-



Nomadic women lead their camels in a search for new pastures. The animals carry the nomads' prefabricated houses, made of wooden frames, animal skins, and mats.

UPI

ments in agriculture and industry and the training of administrators and technicians. Recent budget figures showed revenues of \$51,000,000 and expenditures of \$49,470,000.

Agriculture. The principal occupation is the raising of livestock. In the early 1970's the number of livestock was estimated at about 6,000,000 goats, 3,950,000 sheep, 2,850,000 cattle, and 2,500,000 camels. The principal cash crop is bananas. In the early 1970's about 392,000 tons of sugarcane and 140,000 tons of bananas were produced annually.

Forest and Fishing Industries. The major forestry products are frankincense and myrrh, which are exported. Charcoal is produced for local use and for export. Timber is cut and shipped to Aden for processing. Fishing is important along the coast and provides fish for local consumption. In the late 1960's about 12,000 tons of fish were caught annually.

Manufacturing. Somalia is developing manufacturing. A cement factory, a cotton gin, a meat and fish cannery, and a textile plant have been established. Other industries include oil-seed and fresh fruit processing plants, leather and shoe factories, and a sugar refinery.

Currency and Banking. The unit of currency is the Somali shilling, consisting of 100 cents (6.19 shillings equal U.S.\$1; 1973), which is issued by the Somali National Bank. The other banking institutions include the Somali Development Bank and branches of foreign banks.

Commerce and Trade. In the early 1970's ex-

ports totaled approximately \$40,000,000, and imports were valued at \$72,000,000 annually. The chief exports are livestock and bananas. Other exports include charcoal, fish, leather and hides, and meat. The principal imports are chemicals, clothing, foodstuffs, machinery, and petroleum. The republic trades principally with Italy. Other important trading partners are the United States, Japan, Saudi Arabia, and the U.S.S.R.

Transportation and Communications. The country has about 8100 mi. of roads, most of which are gravel roads. A government-owned airline, Somali Airlines, provides internal service and international flights to Aden and Nairobi. Several foreign airlines provide international service. Two government-owned radio stations broadcast in Arabic, English, Italian, Somali, and several tribal languages. Six newspapers and periodicals serve the country.

GOVERNMENT

Somalia is governed by a Supreme Revolutionary Council, having twenty-five members. Chief executive authority is vested in the council's president, General Muhammad Siad Barre (1920-). The council has executive and legislative authority and oversees a council of fourteen secretaries responsible for all government ministries. The highest judicial body is the supreme court.

SOMALIA

HISTORY

The history of the region now included in Somalia dates back to antiquity, when the land was known to the ancient Egyptians as Punt. From the 2nd to the 7th centuries A.D. the area was a part of the Ethiopian empire of Aksum (see ETHIOPIA: *History*). Arab tribes in the 7th century settled along the coast of the Gulf of Aden and established the sultanate of Adel, which centered at the port of Zeila. The Somali people began slowly to migrate into this region from Yemen (now the Yemen Arab Republic) in the 13th century. The sultanate disintegrated during the 16th century into small independent states, many of which were ruled by Somali chiefs. Zeila became a dependency of Yemen, which was then a part of the Ottoman Empire.

The first European power in the region was Great Britain. In order to protect British trade routes and provide safe anchorage for ships, Great Britain took possession of Aden (now in the People's Democratic Republic of Yemen) on the Arabian coast in 1839. Subsequently, about 1875, Egypt, disregarding Turkish claims, occupied some of the towns on the Somali coast and part of the adjacent interior. When the Egyptian troops left the area in 1882 to help stem the revolt of the Mahdi (q.v.) in the Sudan (see SUDAN, REPUBLIC OF THE: *History*), Great Britain occupied the territory in order to safeguard the route to India through the Suez Canal, which had been opened in 1869. In 1887 a British protectorate, known as British Somaliland, was proclaimed. The protectorate, which initially was a dependency of Aden, was placed under the administration of the British foreign office in 1898 and under that of the colonial office in 1905.

Italian interest in the Somali coast developed in the late 19th century. Through treaties negotiated with native Somali sultans, and conventions with Great Britain, Ethiopia, and Zanzibar, Italy acquired a foothold along the Indian Ocean coast.

British control of the interior of the protectorate was challenged between 1899 and 1910 by native revolts. In 1910 the British abandoned the interior and withdrew to the coastal region. They finally subdued the rebels in 1920. During this period Italy extended control over the area inland from the Indian Ocean coast by virtue of the provisions of the Treaty of London in 1915 and by various postwar agreements. In 1936 Italy merged Italian Somaliland, Eritrea, and the newly conquered Ethiopia into the colonial state of Italian East Africa. After the Italian entrance into World War II on the side of Germany in 1940, Italian troops invaded British So-

maliland and succeeded in expelling the British. In 1941 Great Britain reconquered the British protectorate.

By the terms of the Italian peace treaty adopted in 1947 after World War II, Italy was forced to renounce title to the possessions in Africa, and responsibility for disposition of these colonies was allocated to the "Big Four" Powers (the United States, Great Britain, France, and the U.S.S.R.). In 1948 the Big Four, having failed to reach an agreement on disposition, referred the matter to the General Assembly of the United Nations. A plan granting independence to Italian Somaliland after ten years as a U.N. Trust Territory under Italian administration was approved by the General Assembly in November, 1949. On April 1, 1950, after Italy had accepted the terms of a U.N. trusteeship agreement, the British military government was replaced by a provisional Italian administration. Italian authority became final when, on Dec. 2, the General Assembly approved the trusteeship agreement. The territory was designated Somalia. On July 1, 1960, by agreement with the U.N. Trusteeship Council, the Trust Territory was granted independence. It merged thereupon with the former British protectorate, to which Great Britain, by prearrangement, had given independence on June 26.

The first president, Aden Abdullah Osman Daar (1908–), elected in 1960, was defeated for reelection in 1967 by former premier Dr. Abdi Rashid Ali Shirmarke (1919–69). On Oct. 15, 1969, Shirmarke was assassinated, and days later a military group, led by Major General Muhammad Siad Barre (1919–), seized power. In 1970 Barre declared Somalia a socialist state, and in the following years most of the modern economy of the country was nationalized. A drought in 1974–75 caused widespread starvation. In mid-1977 ethnic Somalis in the adjacent Ogaden region of Ethiopia initiated open warfare aimed at ending Ethiopian control of the area. The rebels were armed by Somalia, which also contributed troops to the effort. The Somalis captured most of the Ogaden by late 1977, but Ethiopia, aided by Cuba and the U.S.S.R., reasserted control over the region in early 1978, as Somalia's army suffered heavy losses. During the fighting Somalia abrogated a 1974 treaty with the Soviet Union, and in April, 1978, Barre signed an economic aid accord with China.

SOMALILAND, region in E. Africa, occupying the "horn" of the continent between the Gulf of Aden on the N. and the Indian Ocean on the S.E., and bordering inland on Ethiopia. Politically it is divided into Somalia and Djibouti.

